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On the *SAE* BATTLEFRONTS

by MAC SHORT

President, Society of Automotive Engineers and Vice-President of Engineering, Vega Aircraft Corp.

AS a nation, we were not fundamentally war-minded; and this does not infer isolationism – we simply have not been thinking constantly of, or making every move toward, total war. The proof of this is to recall our military position over the past years.

Our air forces were surprisingly small. The total number of aircraft delivered to the Army and Navy air services ten years ago, hardly exceeded two days' production at the close of 1942. There was no strenuous development of new and larger bombers, faster pursuits, higher powered engines, bullet-sealing tanks, turrets, and armor plate – simply the meager research and development of a much neglected peacetime air service. There was no aggressive development of mechanized military equipment, fast track-laying tanks, high-speed combat vehicles and other automotive ordnance that today is in mass production in our industry – the industry which is so completely represented by the SAE.

Proof of this absence of military development was ironically brought out at a very peace-minded SAE Tractor Meeting held in Milwaukee in June, 1936. It was there that John Christmas, a Society member – then a Major in the Ordnance Department of the Army – presented as a concluding remark in his paper the fact that the limitations of the wheeled vehicle as a fighting machine were apparent. The need for a wide commercial adoption of fast, track-type vehicles was obviously mutually advantageous to industry and national defense.

As the country worked out of the depression, our engineering efforts were concentrated on automotive equipment for commerce. *Munich,* however, brought to us the realization that we must divert some of our production to defense materials if we were to maintain any sense of security.

The pattern of the mechanical equipment necessary for this security, it now appears, was not too clear in the minds

. . . *from coast to coast* . . .

THIS is a report from the President of the Society of Automotive Engineers to its members on the significance and effectiveness of their joint efforts in helping to win the war.

It is drawn from talking with members, from participating in scores of committee sessions, and from attending technical meetings from coast to coast, as well as from the factual records and statements from Government agencies currently being served by the Society.

Among the Sections before which President Short already has discussed this SAE war record are:

Southern California, Northern California, Northwest, Oregon, Metropolitan, Philadelphia, New England, Southern New England, Cleveland, and Detroit.

of our military strategists and representatives of the Government. Airplanes, trucks, and other automotive equipment ordered by Great Britain and France during 1938 and 1939, and before Lend-Lease, were generally an adaptation of current commercial vehicles or production orders for a military design that had proved to be of worth in our miniature program of developing prototypes; we were not talking big armies, navies, or air forces.

In our pre-war dealings with the Germans, they were buying our trucks but insisting that the frames be drilled for live front axles, while we were interested in building trucks which would transport industrial and agricultural products over paved roads at a low cost per ton-mile – and, to that end, our Society's engineers have been highly successful.

We did not have optics in production for gun sights because – a peace-loving and commercial-production nation – we were busy trying to build a candid camera for a few dollars.

While we were striving to make cheaper chrome-tubing baby carriages, the Germans were already substituting wood and using theirs to represent mobile material in mock battle. These examples are not thrown out as necessarily critical remarks – they are simply facts that we should and must face in analyzing our position. Nobody wanted deliberately to break his pick on the problem of preparing for our battlefront.

■ Early Foresight

I repeat: to evaluate properly the progress along our automotive battlefront, we must look in retrospect to the days before Munich and our own peace-loving, highly commercial, and highly competitive automotive industry. Our battlefront in that period before Munich was the salesroom and the balance sheet. However, even at that early date, through the foresight of certain of our members, the SAE was already gaining recognition for its military engineering contribution to our own newly created defense program.

Munich came shortly thereafter. The rule of military force became rampant and the world began to realize then, as never before, that Hitler had put this war on wheels . . . our production wheels.

Through the years, since the end of World War I, the automotive industry, by hard work coupled with ingenuity and the brilliance of its engineers, had shown the world how to mass-produce the majority of the equipment that Hitler threw against Poland and the Low Countries.

You will recall the events of the next year – the formation of our own national defense program. It was then that the Society formed its first real war council for the SAE battlefronts. At the summer meeting in June, 1940, the SAE National Defense Committee was established, with Past-President B. B. Bachman (vice-president of Autocar Co.) as chairman, assisted by Col. H. W. Alden of Timken, J. H. Hunt of General Motors, Dr. George Lewis of the NACA, Arthur Nutt of Wright Aeronautical, and others.

During that same formative period of '40, other SAE men were called into action on industrial or Governmental defense programs – Knudsen, Stettinius, Wright, Batt and many others.

These men with their various groups went into action at once. This spirit of cooperation on our engineering front is in striking contrast to the compulsion characteristics of

Our Secret Weapon

by WATT L. MORELAND,
Owner, Moreland Motor Truck Co.

(Excerpts from talk given at Southern California War Production Clinic, for which the SAE was one of the sponsors.)

EVERYTHING that we have fashioned from nature's raw resources is the brain child of some engineer, technician, or artisan. Their dreams and ideas and methods, plans and techniques – expressed in constructions – constitute a large part of the real wealth of our civilization.

I take great pride in having been a member for 35 years of one of the greatest engineering societies in the world – measured in accomplishments within a limited time, the Society of Automotive Engineers.

Forty-one years ago, this engineering organization was founded upon the principle of the free interchange of ideas, processes, methods, and experience.

This coordinated effort created the great motor vehicle as we now know it, and the business. But for this coordinated effort and the teaming up for the common good, the automobile would still be the rich man's expensive play toy.

The Society of Automotive Engineers has been through two wars. . . . A little more than two years ago, after the Germans had swept over Belgium, Denmark, and France we were again threatened.

At the request of our Government, the entire SAE organized for war. All of the old war committees that existed in World War I were set up, and many new ones. The Aeronautical Division immediately swung into action.

That was before Congress had made any appropriations, and the expense of the work was borne by the manufacturers who employed these engineers. On THAT DAY, war began for the Society of Automotive Engineers.

Like the motor-vehicle manufacturers, the engineers of the airplane manufacturers have long been working together, standardizing, improving, and producing by the interchange of ideas. Today, more than 1,500,000 copies of aeronautical material specifications have come into circulation. The great airplane manufacturers themselves have formed a war council where they not only interchange ideas, but they interchange material, construction, and personnel.

This great coordination and cooperation is AMERICA'S SECRET WEAPON.

the Axis. They promptly laid the foundation for our future production planning and lined up the anchor points of the longest production battlefront in this war, the true impact of which will not be fully realized until the shooting is over.

The technical accomplishments of the Society's War Activity Council through the months following June, 1940, have been published in some detail in past issues of the *SAE Journal* and in reports and technical papers. The benefits have been felt in virtually every plant in this country producing mechanical war equipment.

It was not until Pearl Harbor that industry completely changed from commerce and defense production to all-out war production.

The SAE was quick to change to the new order – not in the sense of adapting itself to existence under the new conditions, but in the sense of forcefully and courageously expanding current military projects and initiating new ones – designed to the need of our Government and our industry for an all-out war on wheels – an *automotive engineer's war*. And right here I should like to inject a bit of logic.

Webster defines "automotive" as "having the power of self-propulsion" and this fact serves to explain why the term "automotive engineer" embraces all the engineers who have to do with planes, trucks, tanks, tractors, motors, materials, and the countless parts which go to make up the self-propelled, liquid-fueled vehicles on land, on sea, and in the air.

■ War Council

As the Society approaches the end of the third year of operation of this war activity, we should be extremely proud of the members who head the War Council. They are the self-same group who initiated the organization and administration of the program. They, who likewise are busy men in their own organizations, have nevertheless continuously given of their time and strength.

These projects which have been and are being successfully prosecuted by the many committees are currently best appreciated and understood through a study of the "Reports of Committees" distributed with the February, 1943, *SAE Journal*.

The projects are of two kinds – those initiated as a result of Government directive and those which are taken on because the job is there to do and we have the "know-how," the equipment and the staff to handle it.

And here I wish to pause a moment to pay tribute to the excellent leadership of John Warner in initiation and development of our SAE War Programs and to the tireless effort of Mr. Warner and his staff. They have all done an outstanding job. I consider it important that SAE members should know of this work and realize that the heavy load of the Society's war efforts has been superimposed on the regular activities handled by the staff under normal conditions.

The Council has endeavored to express its appreciation: the armed services have been clear in their praise; and it is my candid opinion that the Axis has been sorely displeased and distinctly halted by their efforts.

We have come a long way on this SAE battlefront – and it is a long way from the machine-tool plants of New England to New Guinea; from the aircraft factories of Burbank to Burma; from Seattle to Suez. Just as our armed forces were first placed on the defensive, so were our engineering and production.

The automotive industry started producing those vehicles, both land and air, that were proven. It stayed in the defensive, more conservative, corner in this mad fight ring of production until it knew its real strength. Sure, we were all late in getting started – late in getting our battlefront organized – but weren't we all? It was well known that SAE committees and groups had been developing highly successful materials, methods, standards, for the production of commercial automotive equipment, but this business of mechanized warfare had been virtually forgotten after 1918. We had forgotten how to design for total war – actually and surely design to kill or be killed.

■ Started Anew

So we had to start anew with turrets, tank tracks, bullet-sealing gas tanks, armor plate, guns, bombsights, adaptations of commercial motor vehicles and the setting up of production of entirely new articles.

This industry, our members and committees, took a good share of criticism from the press and radio. Conversion had been inadequately understood or explained. The public was led to believe, by uninformed or unscrupulous people, that only a short time would be needed to convert a plant producing automobiles or parts thereof to the production of airplanes or their components. The hue and cry was "Production!" but few analyzed war production in terms of peacetime output.

Many of you were intimately acquainted or connected with the conversion: Touring sedans to tanks, tractors to torpedoes, seeding machines to shells, bodies to bombers.

It was due to the "know-how" of one engineer or production man passing along to the other that our battlefront came through and produced. The cooperation, the trading of engineering knowledge, was spontaneous, and the Society members became leaders in this time-saving interchange philosophy.

■ Harmonious Cooperation

It was not a shot-gun wedding of engineers from the East with those from the West; or from the North or the South. I can assure you emphatically – as one in the aircraft industry working closely with the automobile engineers, the parts manufacturers and others who had previously been little interested or long engaged in the National Defense Program – that our cooperation was voluntary and harmonious.

Obviously this conversion and acceleration was an engineering job and – while it was passing from the "Who done it" to the "Who won it" stages in an infinite number of hard steps – I say to you no single agency, group, or influence can be awarded all the credit. It is a valid case of free enterprise in engineering and production as well as management.

We have never lost a war yet and we don't intend to lose this one. The engineering and production front has changed from a defensive position to an offensive or attack position in the past few months. It lost the battle of words on conversion to war production – it's winning on the basis of its action. Schedules are being met or exceeded and we are settling the question of whose equip-

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W.E.B. Iron and Steel Committee ACCELERATES Comparative Tests o E

A Foreword—by W. P. EDDY, Jr. *Chairman, W.E.B. Iron & Steel Committee and Executive Engineer, Yellow Truck & Coach Manufacturing Co.*

. . . NE 9400 Series – newest of the emergency steels – has been designed to permit maximum utilization of the residual elements in currently available scrap as well as to get maximum value from minimum percentage of critical alloys specified.

These new steels cannot be applied to production parts for Ordnance vehicles until their suitability for specific applications has been determined beyond reasonable doubt.

Predetermination of suitability requires either extensive road testing of vehicles containing parts made of the new steels (a time-consuming and expensive process) or a laboratory test program consisting of dynamometer or other performance tests simulating service conditions on full-sized parts and assemblies capable of producing equal assurances much quicker.

Ordnance decided upon the laboratory program – and asked the Iron and Steel Committee of the War Engineering Board to set it up and carry it through as quickly as possible. Availability of NE 9400 steels in quantities sufficient to make possible construction of the parts to be tested was the only limiting factor on speed.

The committee swung into action several months ago, adding this program to its already crowded agenda of wartime metallurgical problems.

Its objective: To recommend the extent to which the new NE 9400 series can be used, not only in place of the formerly common SAE 2000, 3000, and 4000 series which contained high proportions of now-critical materials, but also in place of the earlier NE 8600 and 8700 series from which many critical items already had been eliminated.

Its method of procedure: To have separate series of tests on a variety of significant parts run by the various committee members in their respective laboratories; and, in the case of each part tested, to run comparative tests between the new NE 9400-built parts and parts made of previously specified steels.

The committee is releasing results only when its members feel that the data are sufficiently comprehensive and significant to be used as the basis of practical production operations. While striving to extend the use of this new least-critical-materials series as far as practicable, the committee does not wish to spread any false optimism about its possibilities.

1. *Impact Tests of TORQUE ROD END PINS*

Submitted by W. P. EDDY, JR., Yellow Truck & Coach Manufacturing Co.

PIN forgings were annealed, and pins were machined and heat treated to hardness of Rockwell C37-40. Each pin was mounted horizontally in a fixture and blows applied vertically, by a 40-lb weight falling 7 ft, to a special nut screwed on the 1 in. – 14 threads on the small end of the pin. The pin was rotated 180 deg after each blow. The number of blows required to produce fracture in the threads was reported. Summaries:

		Hardness (Rockwell C) Surface	Center	Number of Blows
SAE 4340	Low	38.5	35	6
	High	38.5	36	8
	Average	38.5	35.3	6.8
SAE 4150	Low	39	35	4
	High	41	40	9
	Average	40	37.2	6.6
NE 8744	Low	37	33	7
	High	38.5	34	9
	Average	37.6	33.5	7.8
NE 9445	Low	37	33	5
	High	38.5	34	7
	Average	37.6	33.5	5.5

E 9400 Series Steels

The tests were conducted as described, because service failures of pins known to be too brittle occurred in the same manner and location as those produced in the tests.

It will be noted that there is little to choose among SAE 4340, SAE 4150 and NE 8744 steels. The NE 9445 results are slightly lower, but sufficiently close to warrant the belief that performance will be satisfactory.

2. Tests of 9420 STEEL

Submitted by D. G. ROOS, Willys-Overland Motors, Inc.

DATA on tests made to determine whether NE 9420 is satisfactory for forgings in the Bendix-Weiss front-axle universal joint on the Willys MB ¼-ton, 4 x 4 truck.

The joints were tested in a four-square set-up with the front wheels turned through their maximum angle of 28 deg. The wheels were loaded at the maximum torque. The motor was driven at a low speed and stopped at half-hour intervals for cooling, in order to prevent scoring of the balls and races. The test continued until 44,300 cycles had been run, when a bad click was developed. This number of cycles is slightly better than the maximum number of cycles satisfactorily performed with joints made of the present optional steels, which are SAE 4027, SAE 4620, NE 8620. At the completion of the test there was no indication of wear or distortion in any part of the joints, although one of the balls was scored.

Effort is being made to obtain approval to use NE 9420 for forgings in the Bendix-Weiss Front Axle Universal Joint.

3. Tests of 9400 SERIES STEELS

Submitted by R. W. ROUSH, Timken-Detroit Axle Co.

NE 9420 has been tested in spiral-bevel gears on the dynamometer and while there was considerable variation in gear life, it is believed it can be substituted for SAE 4620 and SAE 4320 in a number of applications. Some of the gears ran 83% of minimum requirements and some of them gave excellent performance, passing maximum requirements. It is believed that NE 9420 is a better gear steel than the AISI 4120. Machining properties, carburizing and hardening qualities are satisfactory. On the basis of tests to date, Timken is willing to go along and use it for medium stressed gearing.

NE 9437 is being fatigue tested in wheel studs in a special test at Budd Wheel Co. It has passed their maximum requirements of 1,000,000 cycles and still going. There is no doubt that it can be used in this application. Steels formerly used were SAE 2320, SAE 3120, AISI 4120 and SAE 4032.

NE 9445 has been made into torque-rod ball studs and tested in impact along with SAE 4340, SAE 4150 and NE 8744. The average results show it to be slightly lower in impact strength, but it is more consistent and is considered to have sufficient factor of safety for this high production application.

No trouble has been experienced in machining any of these steels. Their response to heat treatment is good.

Timken has under way fatigue tests on steering arms and steering knuckles made of NE 9430. Also torsional fatigue tests on axle shafts made of NE 9442 and NE 9445.

Timken has approved NE 9440, NE 9442 and NE 9445 for a number of studs, bolts and cap screws for production. These are hardened and drawn to 269-321 Brinell.

Timken has also approved NE 9420 for a number of small carburized and hardened parts. As more tests are made, it is believed this steel can be approved for a large number of production parts.

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More to Come

THE Iron & Steel Committee of the SAE War Engineering Board, of which Mr. Eddy is chairman, consists of: A. L. Boegehold, General Motors Corp.; Hyman Bornstein, Deere & Co.; W. H. Graves, Packard Motor Car Co.; H. B. Knowlton, International Harvester Co.; E. O. Mann, Chevrolet Motor Division, General Motors Corp.; F. E. McCleary, Chrysler Corp.; R. W. Roush, Timken-Detroit Axle Co.; R. B. Schenck, Buick Motor Division, General Motors Corp.; E. H. Stilwill, Chrysler Corp.; and F. C. Young, Ford Motor Co.

The committee's testing of NE 9400 Series steels is continuing, the data presented in this issue of the SAE Journal being only the first results of this important test program.

Results of further tests will appear from month to month as additional data become available.

FIELD MODIFICATION

by LT.-COL. H. O. MATHEWS
Ordnance Department, A.S.F.

A MODIFICATION is defined as the partial alteration of anything, and as applied to Army vehicles it means changing a part or parts of the vehicle to correct a deficiency or a malfunction of the part, or making an addition to a vehicle in the hands of the using troops.

Instructions to field organizations are that no modification which will affect the working parts of Ordnance items and equipment shall be made without the prior approval of the Chief of Ordnance, except in an emergency when the approval of the local Ordnance officer will suffice.

In order to provide the field with data and orders on which to make the necessary changes in Ordnance materiel, with particular reference to automotive, there has been established within the Maintenance Branch, Tank-Automotive Center, Detroit, a Modification Section the duties and responsibilities of which are as follows:

1. Analyze field reports on malfunctioning and defects.
2. Initiate Product Correction Reports.
3. Initiate, prepare, clarify, number and forward Field Service Modification Work Orders on Tank-Automotive materiel for publication, and distribute advance copies.
4. Initiate procurement of necessary modification material and follow up.
5. Direct storage and issue of such material.
6. Effect and pursue application of modifications until all are completed.

■ Three Types of Modifications

It can be said that there are three broad types of modifications. In the first place, with the volume of equipment that is designed and built, operational difficulties are bound to occur after the equipment is put into service. Modifications therefore become necessary to correct any such condition in the field. Next, there is the matter of constant improvement in production. In many cases it is deemed advisable to incorporate these improvements in vehicles and equipment already in service, and modifications are therefore made along this line. The third type of modification is made when it is necessary to adapt a certain vehicle to a special job. It must be borne in mind that all this equipment is intended for more or less general use in a particular field. When it is used under extreme conditions, certain changes become necessary. An example of this is the installation of a desert kit, consisting mainly of a radiator surge tank, on trucks to be used in the climates where high temperatures prevail.

Modifications are originated from many different sources, depending upon the nature of the modification itself and the type of vehicle or equipment concerned. One of the principal sources is reports from using organizations. Such reports are received by a variety of means, such as verbal conversations, letters, formal reports.

A definite system has been set up to enable using organizations to report the defects and deficiencies of their equipment direct to the Tank-Automotive Center, Maintenance Branch, Modification Section.

A simple report form has been provided, and these reports are filled out by the responsible officer and can be sent direct to the Modification Section; thus the information received is first-hand and authentic. Such reports are accumulated and tabulated. This makes it possible to determine very soon whether any specific correction is necessary. In other words, should a particular malfunction occur repeatedly, the information is at once furnished to the Engineering Branch, which immediately undertakes an investigation of its own. This investigation may result in a change in production as well as changes on all vehicles in actual service. The Modification Section of the Maintenance Branch will make the decision regarding the vehicles already produced.

Another source of vehicle performance information is the field inspectors, who are in constant contact with all using troops and submit regular reports of malfunctions which are brought to their attention during inspections. Members of the Inspector General's office are also in a position to furnish this type of information, and their reports are received and reviewed by the Modification Section.

Another important source of very valuable data is the manufacturers' field representatives. Every manufacturer has a considerable field staff, and these men work very closely with the Ordnance Department. Their representatives are valuable especially in that they also report to the manufacturer, and thus help to coordinate any program which may be considered necessary. The importance of this particular activity cannot be over-estimated.

A continual contact is also maintained with representatives of the United Nations, who report the performance of our equipment in the hands of their troops.

Tests are constantly carried on at the various proving grounds – those of the various manufacturers and of the Ordnance Department. The results are always available.

Engineering changes made in production constitute another important source of information. Naturally, the Engineering Branch of the Tank-Automotive Center and the engineering departments of the various manufacturers are continually improving their products. These engineering changes are made available to the Modification Section and are carefully checked with reference to the desirability of making changes in the field. Frequently, the Engineering Branch issues a request for a modification order, to be issued to the field when considered necessary for the improvement of the safety or efficiency of the vehicle.

Periodically, the Ordnance Committee meets and the

[This paper was presented at the SAE National Transportation and Maintenance Meeting, New York City, May 5, 1943.]

ORDNANCE VEHICLES

items they decide should be changed are reported to the Modification Section, and corresponding action is taken.

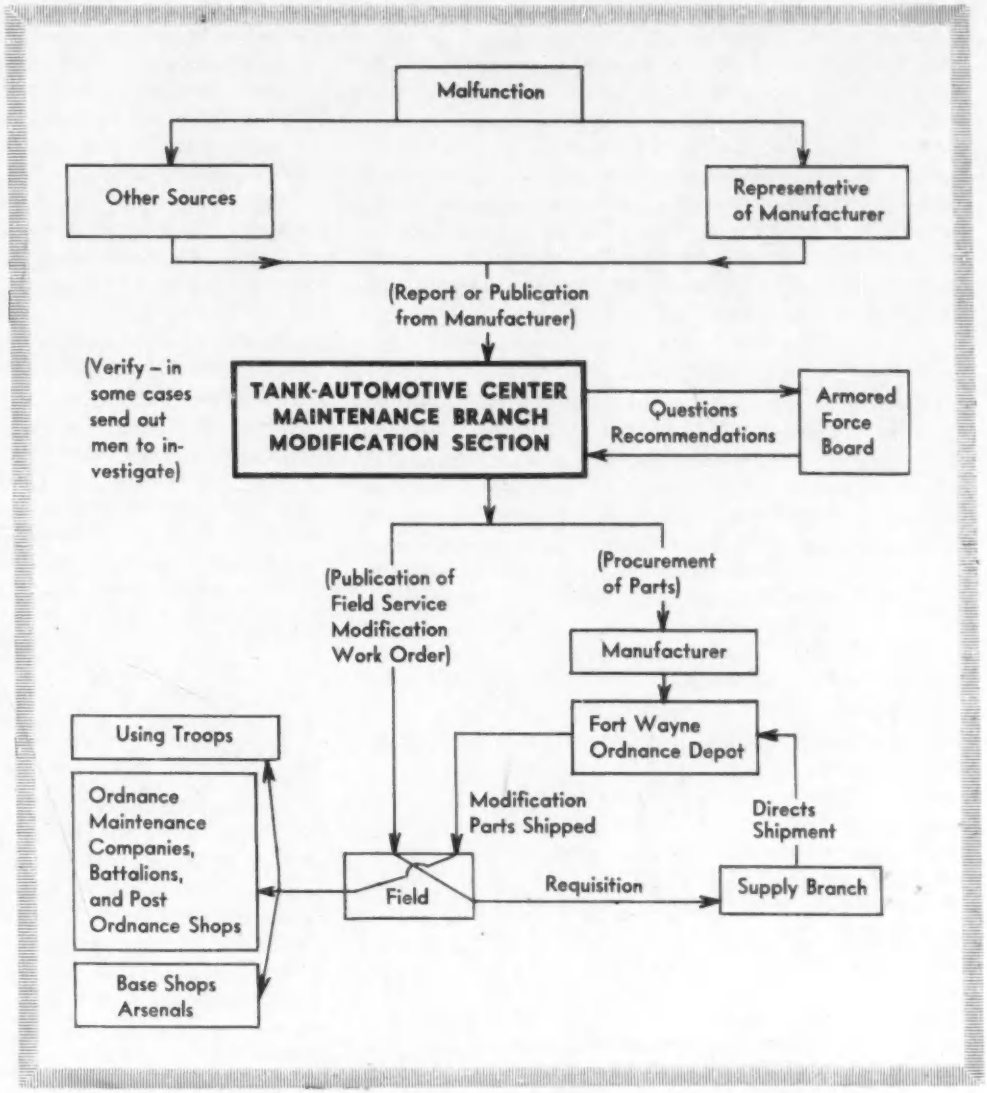
Modifications are frequently initiated upon directives from higher authority. These modifications are often of the type where it is necessary to make alterations to adapt certain equipment to a special job.

In this global war nearly every climatic condition is encountered and practically every kind of operating condition has to be met. Obviously it would be impossible for a manufacturer to build a vehicle or other equipment in such a way as to adapt it to such broad uses.

When a modification is initiated it is necessary for the Modification Section to give it careful consideration from many different angles. One of the most important things to think about is the amount and kind of material which will be needed. Next, the type of equipment and its location are important. Most important of all is the necessity of deciding whether or not the proposed program actually improves the durability, safety, and combat efficiency of the vehicle. If it does not, it is quite likely to be dropped. Every effort is made to avoid any modification which is not absolutely essential. This decision requires a very wide investigation with using troops, with higher authority, and with the Engineering Branch.

The Modification Section, as it now operates, is divided into two main units: Preparation and Application.

The Preparation Unit collects the information for a particular Field Service Modification Work Order, and by working with the Engineering Branch of the Tank-Automotive Center gets the work order in shape so that it can be issued to the field.



Functioning of Modification Section, Maintenance Branch of Ordnance Tank-Automotive Center

The Preparation Unit personnel is made up of specialists on the various types of vehicles and equipment; for instance, it is necessary to have a man who is very familiar with radial engine work, one who is familiar with the half-track type of vehicle, with the various types of four-wheel drive trucks, and most important of all, men familiar with the various types of tanks. A specialist is also provided for crawler tractors, of which the Ordnance Department uses a large number.

The project is given to the individual who specializes in the type of equipment it covers. This individual is then held directly responsible for its preparation. He immediately starts his investigation of the problems to be solved

and gets in touch with the manufacturer. He also works directly with the Engineering Branch of the Tank-Automotive Center, contacting the section of the Engineering Branch which specializes in that particular equipment. He obtains the necessary drawings and bill of material covering parts needed and then proceeds to write the Field Service Modification Work Order itself.

As soon as it has been decided what parts are needed, a sample kit is procured and a test installation is made. This test installation is very important, as can readily be seen, for frequently the plans do not work out as contemplated. A test installation is generally made in conjunction with the Engineering Branch, and whenever possible with the engineering department of the manufacturer. When the party responsible for the work order has completed writing it, it is carefully edited and is then submitted, together with drawings or photographs, to the Military Publication Section of the Ordnance Department, and distributed to the field.

■ Quick Action Required

Variations of this program are frequently necessary. In some cases a difficulty may arise in the field which requires immediate attention. Considerable time would elapse before the Engineering Branch could institute changes in production. As a result, it would be impossible to procure the necessary parts from production. In these cases, it is the duty of the Modification Section to devise what is termed a "quick-fix." In doing this, the Engineering Branch is consulted and their advice and assistance are utilized. It is then possible to go into the field at a very early date with a correction, and have it applied by the time a production change has become effective.

As an example of this type of modification, a recent improvement on half-track vehicles can be quoted: It was necessary to provide more flexibility for the track suspensions, and the rear track idler was fitted with a spring-loaded plunger arrangement which maintains track tension and still allows play under extreme pressure. Many vehicles were in the field and it was necessary to have this correction at once. The necessary parts were devised and corrections were well along in the field by the time a more permanent type of correction was made in production. In many cases, the development of a "quick-fix" correction aids quite materially in making permanent changes in production.

Perhaps it would be desirable again to mention the fact that any modifications taken up by the Modification Section are placed in the hands of an individual who is a specialist on that particular type of equipment, and is left with the individual until the work order is complete and ready for issue to the using organizations in the field.

It may also be of interest to outline briefly the type of information carried by a Field Service Modification Work Order. First of all, the type of vehicle or equipment covered must clearly be stated. In some cases only vehicles going to a certain place or being used for a certain purpose will be covered. The number affected must also be given and the determination of that number is an important function of the Modification Section. Next, instructions for ordering parts must be given to the using organization in order that they may quickly obtain the material, together with the necessary tools. Then a detailed description of the mechanical operation is given.

Every step must be carefully covered, for it must be borne in mind that in many cases this work will be done by soldier mechanics who may not be very familiar with the mechanism they are working on. Sketches and photographs are provided as necessary, and careful reference is made to the various parts of any mechanism.

Another important thing to be considered is whether or not the operation as outlined can be performed by the field. It would be useless to ask first, second, and third echelon maintenance to perform work that must necessarily be done in an arsenal. It is of the utmost importance, therefore, to determine who is going to do the work and make it plain, in order that nothing will be undertaken which cannot be finished.

Instructions must also be given in a Field Service Modification Work Order as to the disposal of parts that are removed, to avoid wasting usable material or critical metals. Instructions must also be given as to the urgency of the work – whether vehicles or equipment are to be taken out of service and modified at once, or whether the modification can be performed during regular servicing.

Not least important is the matter of tools. The tools to be used must carefully be listed and provision must be made for their procurement. This applies mostly to tools of a special nature. Last of all, information is given as to reporting finished work to the Modification Section. The preparation of modification work orders is rather a complicated process, requiring thought and attention to detail.

Every modification program differs from the one before it, and the process to be followed must be flexible to allow for special conditions. The fact that each project is assigned to a specific individual enables a study of the particular problems to be made so that they may be met as well as possible.

The closest contact is maintained with the Engineering Branch during the preparation of the work order. This is necessary to make certain that no other parts of the vehicle are adversely affected or that some inadvisable expedient is adopted. Drawings must also be available, and are obtained from the Engineering Branch. These frequently have to be redrawn and prepared for reproduction by the Modification Section.

Another contact is most important, namely, that with higher authority in the different branches of the Army. In making modifications the military characteristics of the vehicle must not be changed without proper approval.

■ Application Unit

This outlines in general the duties of the Preparation Unit of the Modification Section, but after completion of this work the modification itself is only partially done. The Application Unit then steps into the picture, and it has to do with the procurement of material, the expediting of this procurement, the storing of parts, the issue of parts, and their installation in the field.

As soon as it is determined exactly what parts are to be used in a modification, the Application Unit is advised what material will be necessary, together with part numbers and other necessary information. They immediately request the Manufacturing Branch of the Tank-Automotive Center to initiate procurement of the necessary material through the Ordnance District supervising the plants in which it is to be produced.

The procurement of modification parts differs quite

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COLD WELDING

Report of Subcommittee, Maintenance Methods Coordinating Committee, SAE Transportation and Maintenance Activity, Submitted to the Vehicle Maintenance Section, Division of Motor Transport, Office of Defense Transportation

★ ★ ★

THE principle employed today in repairing cylinder blocks, cylinder heads, and so forth, and publicized as cold welding, has for years been known as lacing. It had not been used very extensively until the War began and shortages made parts impossible or hard to get simply because relatively few operators knew about it.

With the emphasis on repair rather than replacement, this method has found far wider acceptance. The Committee feels that the acceptance has been retarded somewhat by the secrecy which has surrounded it. Some specialists in this method refused to permit the vehicle operators to observe work in process and failed to give them any description of it. When the work is completed, it is hard to determine the technique employed. Because of the complete ignorance of the method which resulted, operators to some degree lacked confidence in it.

■ Limitations of Cold Welding

The Committee has been unable to find any practical way of defining the limitations of the process in repairing cracks in engines. New applications are being attempted almost daily and the results are uniformly successful. On the conservative side, it seems safe to report that 95% of the engines suffering from the following types of failures can be successfully repaired:

Cracks running from the valve seat to the cylinder wall.

Crack in the crankcase running the full length and through the main bearing support.

Cracks and holes in the crankcase caused by failure of the connecting rod.

Cracks in the exhaust ports.

Cracks in the valve chamber.

Cracks in the head of an L-head engine.

Freeze cracks where a piece of metal is missing.

Cracks either vertical or horizontal behind the valve guides.

Cracks in the metal around the cylinder-head or rocker-arm bolt holes.

Cracks in the water-pump bodies.

There is no difference in the results on gasoline, diesel, overhead or L-head engines. Cold welding has been equally successful on steam and marine engines. Any type of engine can be successfully treated. Figs. 1 to 4 are photographs showing how cleanly repairs can be made by the cold welding process.

Cold welding has been used successfully on all types of liquid-cooled engines in all types of services. Antifreeze has no effect upon the repair. Engines, used in passenger cars, truck fleets both light and heavy, and city and inter-urban bus fleets, have been repaired with this method. The repair apparently lasts as long as the engine. There is no record of a repair failing as a result of time or mileage. The Committee does have record of repairs lasting 200,000 miles. The Committee has service records of repairs, performing in temperatures ranging from —10 to 106 F.

The Committee, in giving enthusiastic endorsement to cold welding as a method or mechanical principle of repairing cracked engine-block heads, and so forth, wishes to make the observation that it is not foolproof. Such failures as have been encountered have been traced to a lack of competency or training on the part of the mechanic who made the repair, or to lack of maintenance of the engine by the operator, or downright abuse of the engine by him. Under this latter condition, the repair shows no greater tendency to fail than the rest of the engine.

Most automotive mechanics would not be capable of performing the work without some training, despite the fact that it is not particularly complicated. The work is tedious and exacting, but not more so than most of the work done by machinists.

Kerkling & Co., Inc., Bloomington, Ind., operates a school which trains mechanics to do this work. There is no charge for attendance at this school.

■ Experience With Cold Welding

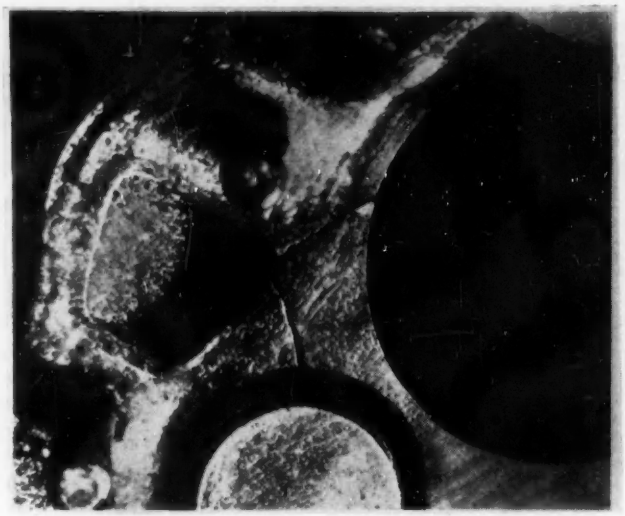
Following is a brief description of the experience of

SAE Maintenance Methods Coordinating Committee

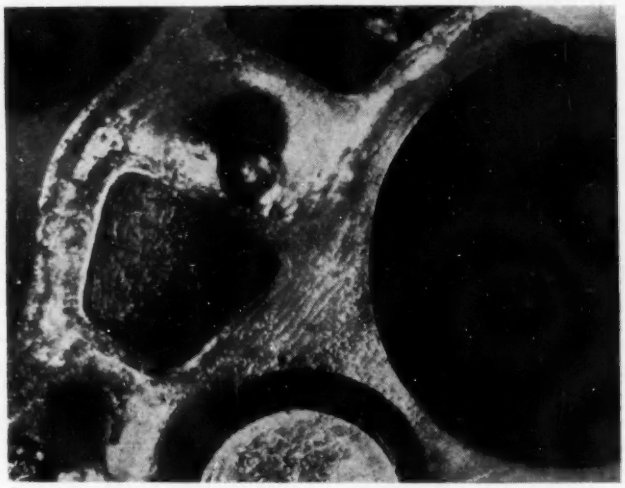
W. J. Cumming, chairman, chief, Vehicle Maintenance Section, Division of Motor Transport, Office of Defense Transportation; E. P. Gohn, test engineer, The Atlantic Refining Co.; M. E. Nuttila, superintendent, Motor Vehicles, Cities Service Oil Co.; G. W. Laurie, manager, Automotive Transportation Department, The Atlantic Refining Co.; J. Y. Ray, supervisor, Automotive Equipment, Virginia Electric & Power Co.; S. B. Shaw, automotive engineer, Pacific Gas & Electric Co.; W. A. Taussig, automotive engineer, Burlington Transportation Co.; E. W. Templin, automotive engineer, Los Angeles Department of Water & Power; D K. Wilson, superintendent, Automotive Equipment, N. Y. Power & Light Corp.; A. M. Wolf, automotive consultant.

Subcommittee on "Cold Welding"

H. B. Truslow, chairman, owner, Richmond Auto Parts Co.; E. H. Blakelock, shop superintendent, Quaker City Motor Parts; W. P. Butt, president, Chesapeake Auto Supply; D. H. Goldman, K. & G. Sales Co.; J. C. Gowing, factory representative, Eutectic Welding Alloys Co.; H. R. Hart, Jr., president, Hart's Automotive Parts Co.; R. B. McClure, vice-president, Parts Service Corp.; R. B. Merrill, president, Baldwin Auto Parts Co.; E. P. Gohn, project chairman.



■ Fig. 1 – Typical internal cracks before repair



■ Fig. 2 – After the cracks shown in Fig. 1 have been repaired

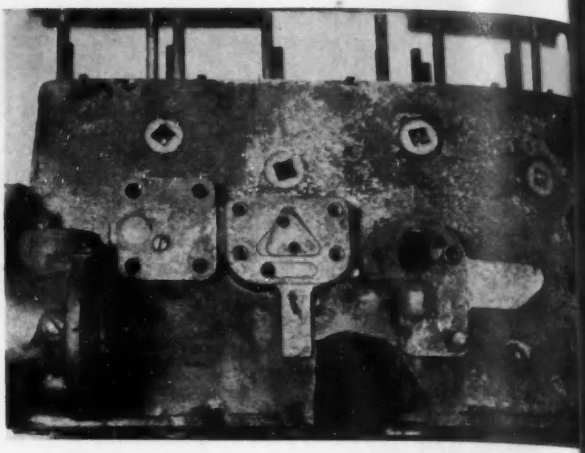
individual Committee members with various types of applications:

"We have found soft and porous spots in diesel-engine heads (defective castings) of such a size that we had to cut out pieces larger than a silver dollar. We made patches to fit these holes and laced them to the head. We then circulated a sealing compound in the water jacket. These heads are now working 24 hr per day on the most severe service possible."

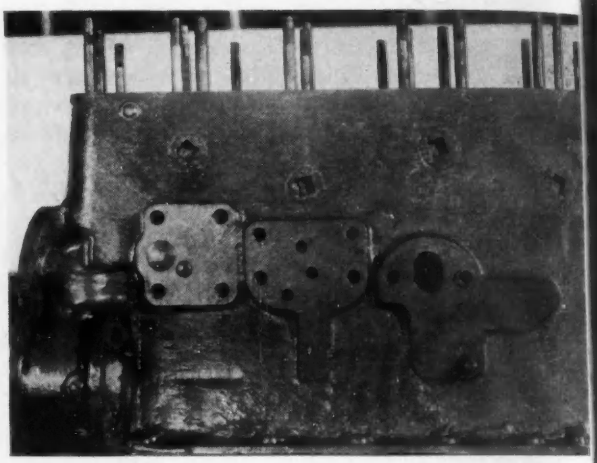
"When cracks from diesel injector to valve seat have been encountered, we rolled the copper fuel-injector tubes away from the head, laced underneath and rolled the tube back, finished the job to the valve port, replaced the valve-seat insert, and the engines returned to regular service."

"One day, when our supervisor was absent, we received a heavy-duty-truck block, split from end to end. If he had been present, he would have refused to attempt the repair. In his absence, our mechanics completed the repair, and the engine returned to service where it is still operating."

"During the latter part of 1939, we repaired a heavy-duty-truck cylinder head that was cracked in four places, one crack running deep into the valve chamber. This truck has been driven 65,000 miles since the repair and is still



■ Fig. 3 – The side of an engine block with a piece broken out – typical external break



■ Fig. 4 – After the engine shown in Fig. 3 has been repaired

taking its regular turn on a route 400 miles long, delivering groceries on a wholesale route."

"We repaired a head that had been frozen and cracked in three places. The worst crack went squarely across the cylinder head and to all appearances the head was cracked into two pieces. This head was repaired and the light truck, of which it is a part, is still in stop-and-go service, delivering laundry with the repaired head intact."

"A tractor engine developed a crack in the valve push-rod chamber clear through to the water jacket, running the full length of the cylinder block from the crankcase to the cylinder head. In this repair, it was necessary to anchor the cylinder block to the crankcase with long studs before lacing and, even then, there was doubt in the minds of some people concerned with the job. However, the tractor has been operating more than a year since the repair with no bad results."

"A crack about 3 in. long, extending a full inch through an intake-valve port and the same distance into the exhaust-valve port, caused water to leak into the cylinder of a tractor engine engaged on road construction work. This crack was repaired in about 8 hr. When finished, it was not necessary to replace either valve seats or guides."

■ Tools and Supplies Required

A supply of commercially available, special-purpose sealing compound.

¼-in. electric drill.

Special-Purpose Rod	Taps	Drills	Dies
1/8	6/32	No. 36	6/32
3/16	10/32	5/32	10/32
1/4	1/4-28 thread	13/64	1/4-28 thread
3/8	3/8-24 thread	5/16	3/8-24 thread

Assortment of chisels.

Miscellaneous hand tools.

Process of Cold Welding

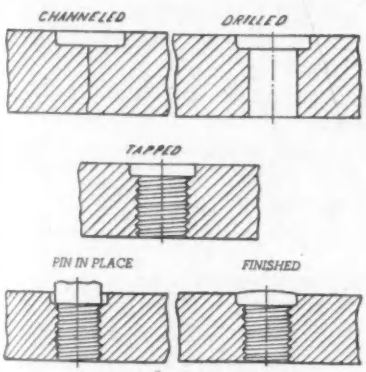
It is extremely important that a very close inspection of any part to be cold-welded be made to determine the exact position and number of cracks. Thorough cleaning in a degreasing tank is recommended.

The ends of each crack must be drilled to prevent further development of the crack. The drilled hole is tapped, and the special rod is screwed into it and cut off. Each crack is drilled and tapped at specified spacing for its entire length, and the special rod is inserted in such a manner that each stud interlocks the one next to it and each stud is peened.

A quantity of sealing compound is then circulated through the cooling system. As a final inspection, hot or boiling water is circulated through the cooling system. This will make it possible to locate any leaks that are not visible to the naked eye.

Procedure for Specific Repairs [1]

Method of Putting in Pins – (All pins referred to in these instructions are made of a special-purpose, commercially available rod.) The steps to be followed for putting in the pins are shown in Fig. 5.



■ Fig. 5 – Procedure for installing pins

1. Cut a channel the width of which is the diameter of the pin to be used plus a small allowance for peening over. This channel should be at least 1/16 in. deep, but the depth will depend largely on the thickness of the metal which is to be repaired and is necessary in combustion-chamber repairs only.

2. Be sure the crack is as near the center of the channel as possible, so it may be drilled squarely through.

3. In channeling for "inlay" through a valve seat, it is necessary to cut deep enough to allow for several valve-grinding jobs. (Channeling is necessary only in combustion-chamber cracks.)

[1] The Committee is indebted to Kerkling & Co., Inc., Bloomington, Ind., for data contained in this section.

a. Drill as nearly perpendicular to the valve face as possible, and tap out for the pin.

b. With a thin, flat or a small, three-cornered file, file the side walls of the channel perfectly smooth and undercut slightly to produce a dovetail effect.

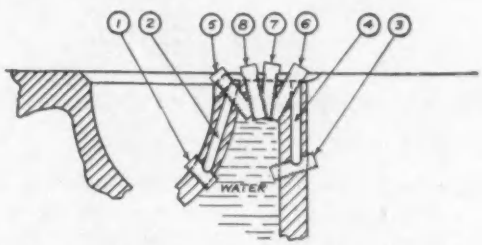
It is very essential that the side wall of this channel be free from scratches or cuts from the tap, as a future valve-grinding job may run into one of these and leave a bad line on the valve seat.

Always remember that the smoother the channel walls and corners, the better the job will look when finished.

After completing the repairs, circulate sealing compound through the cooling system.

Each pin should be dipped in sealing compound before installing.

L-Head-Type Valve Seat Repair – (See Fig. 6.)



■ Fig. 6 – Position of pins in L-head-type valve-seat repair

1. Determine the ends of the crack.

2. Saw through the valve seat, with a hack saw for a channel, the width of which is the diameter of the pin used plus a small allowance for peening over. Be sure the crack is as near the center as possible, and cut out with a caping chisel of proper width.

3. Work from both ends toward the center of the crack to prevent chipping at the cylinders.

4. Drill for and install pin No. 1.

5. Drill a ⅛-in. hole from a point in line above, following the crack through the valve-chamber wall into pin No. 1; cut a ⅛-in. pin about 1 in. long; put some sealing compound in the hole; insert the pin (which is No. 2) and pin down with a square-ended punch. Cut off any surplus metal which may stick up in the bottom of the channel.

6. Install pin No. 3 in the cylinder wall, and proceed with No. 4 the same as with No. 2.

7. Drill and tap for No. 5 pin (see section following *L-Head Repair – Inside*) and proceed with Nos. 6, 7, 8, and so forth.

The number of pins depends on the length of the crack, that is, if it is a very short crack, pin No. 1 may catch the end – placed immediately under No. 5, making No. 2 unnecessary. No. 8 could be No. 2, and No. 5 would be the third and last one.

If the crack is too long for the number of pins shown in Fig. 6, see Fig. 9.

8. Be sure the pins are cut high enough to allow plenty of metal to fill the channel. An insufficient amount makes a bad-looking job, whereas, a surplus may be easily cut off.

9. In peening, always use a light hammer or a special-purpose pneumatic hammer, as heavy blows will shatter the threads in the cast iron and the job will be loose.

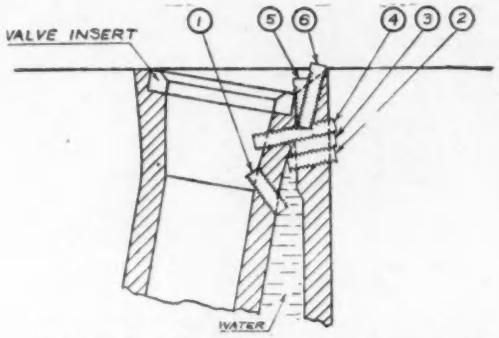
If the valve seat has an insert, remove it; channel from the top over and pin as above. If the crack has opened

enough to loosen the insert, it will be necessary to install an oversize one.

After completing the repairs, circulate sealing compound through the cooling system.

Each pin should be dipped in sealing compound before installing.

Ford V-8 Valve-Seat Repair – (See Fig. 7.)



■ Fig. 7 – Position of pins in Ford V-8 valve-seat repair

On some models of the Ford V-8, the intake-valve seats do not have an insert. It is not necessary to cut out and install an insert.

1. Install pin No. 1 at the lower end of the crack in the valve port.

2. Install pin No. 2 at the end of the crack in the cylinder wall.

3. Install pin No. 3, if necessary. (In some instances, pins Nos. 2 and 3, and even No. 1, are not necessary.)

4. Pin No. 4 goes through solid metal. Start this one by punching for a drill, 9/16 in. from the top of the cylinder, and slant slightly to come out below the insert. This one pin will shut off any water from coming up into the cylinder.

5. If the insert is not loose, do not remove it. Channel from the edge of the cylinder down to the insert. Put in pins Nos. 5 and 6. Peen them into the channel and finish off. Pins Nos. 5 and 6 are merely to finish out and hide the crack across the top. The cylinder is now ready to be either honed or bored. This operation has proved very satisfactory in the steel-sleeve type.

The repair below pin No. 2, which will be about 7/8 in. from the top, is not recommended, as the wall thins out at about 1 in. and below that, for this repair, a cast- or heavy-type sleeve is recommended.

The crack, as shown in the valve port between pins Nos. 1 and 4, will be taken care of with the application of sealing compound through the cooling system after the engine has been installed.

Some blocks are thick enough in this particular area to be pinned all the way up, but some are so thin that an attempt to pin them only invites trouble.

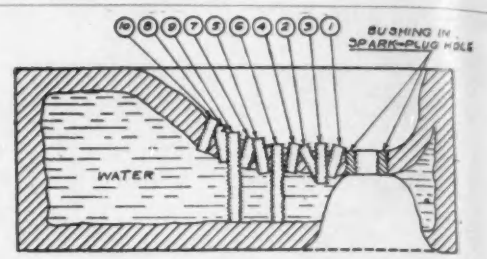
After completing the repairs, circulate sealing compound through the cooling system.

Each pin should be dipped in sealing compound before installing.

L-Head Repair – Inside – (See Fig. 8.)

Various cracks occur in L-type heads, but the most serious one is from the spark-plug hole out across the roof, as shown in Fig. 8.

Make this repair as follows:



■ Fig. 8 – Position of pins in L-head repair – crack from the spark-plug hole out across the roof

1. Ream out the spark-plug hole, tap, and install a bushing. (The most satisfactory material for a bushing is a cast-iron pipe plug.)

2. Channel from this bushing, keeping the crack in the middle, on across to the end of the crack.

3. Insert pins Nos. 1, 2, and 3, and so on across, and brace on to the top of the water jacket as shown by pins Nos. 6 and 9 in Fig. 8.

4. Check the slant of the combustion chamber with the top side of the head, as it may be necessary to brace with an angle pin such as No. 2 or No. 4. This operation braces the inner chamber against springing up under pressure of explosion.

In cases where the crack does not run into the spark-plug hole, proceed as shown in Fig. 8, by starting in one end, making pin No. 1 straight through as shown by pin No. 10 in Fig. 8.

Outside or freeze cracks, in this type of head, should always be pinned through each end and should be doweled about every 1 in. in between the ends to eliminate any possible vibration or crawling at changes of temperature.

An outside crack in the head may be easily repaired without removing the head.

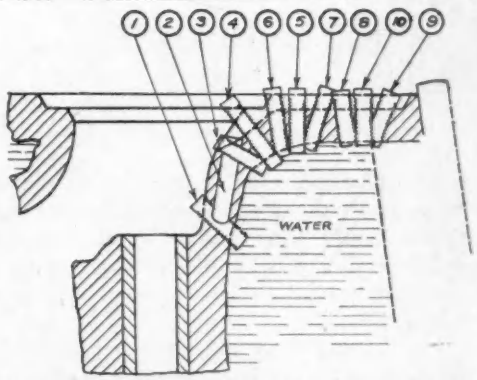
Removed heads should be checked carefully for warpage, and if warped, should be lined or face-ground before replacing.

After completing the repairs, circulate sealing compound through the cooling system.

Each pin should be dipped in sealing compound before installing.

Caterpillar Diesel – (See Fig. 9.)

This crack, when it occurs, varies in length, sometimes



■ Fig. 9 – Position of pins in Caterpillar diesel valve-seat repair

running from the shoulder beside the valve guide up through the seat and across the surface beside the fuel-injector tube.

1. Channel from the shoulder just below the valve seat

(always using a hack saw where possible) and across the surface to the end of the crack.

2. Install pin No. 1, as shown in Fig. 9.

3. Drill a ⅛-in. hole from the shoulder under the valve seat down the wall of the valve port and into pin No. 1, following the crack all the way down. Cut a pin of ⅛-in. special rod slightly longer than the depth of the hole, dip in sealing compound, and peen straight down with a punch to swell it in the hole, as shown by Figs. 6 and 9.

(This operation is possible where the crack runs reasonably straight. If there is a curve or bend that cannot be followed by line drilling, it is then necessary to stack pins or lace from No. 1 on up.)

4. In some instances, it may take two pins to bring the metal up to the proper place at the valve seat, whereas, Fig. 9 shows one pin, No. 2.

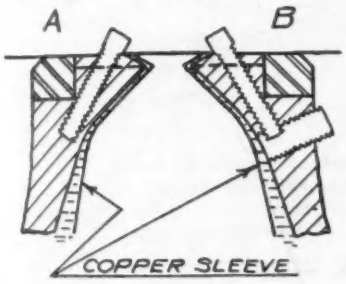
5. It is extremely necessary to put pin No. 4 as near the center of the valve seat as possible, always preparing this operation as described for valve-seat inlay under Fig. 5.

6. Proceed with pins Nos. 5, 6, and so forth, to the end of the crack, then peen and finish.

After completing the repairs, circulate sealing compound through the cooling system.

Each pin should be dipped in sealing compound before installing.

Cummins Diesel – (See Fig. 10.)



■ Fig. 10 – Position of pins in Cummins diesel head repair: A – repair made without removing the copper injector tube; B – repair made with the copper injector tube removed

Fig. 10 shows a crack that might occur in Cummins diesel heads from the valve insert over to the injector tube.

This crack generally runs only from the inside corner of the insert seat to the injector tube. To make a repair of this type, proceed as follows:

1. With a slim-taper, lining-up punch, drive snugly in the injector hole.

2. With a very sharp, thin chisel, carefully lift the flange of the copper tube.

3. Cut a channel with a sharp, ⅛-in., caping chisel, from the insert over, going about half-way down in the countersink for one copper flange.

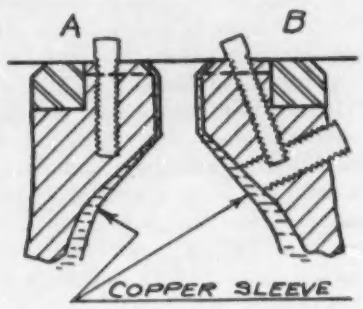
4. Drill the hole, starting at edge of countersink, at a slant just sufficient to miss the corner of the insert. This hole should be about 7/16 in. deep. Use a No. 36 or No. 38 drill, and tap with a ⅛-40 or No. 6-32 thread. The taper punch may be removed for this operation.

5. Insert a threaded pin of ⅛-in. special rod. Replace the punch tightly in the injector hole, peen, and finish. Lay the lifted flange back down carefully and remove the punch.

After completing the repairs, circulate sealing compound through the cooling system.

Each pin should be dipped in sealing compound before installing.

General Motors Corp. Diesel – (See Fig. 11.)



■ Fig. 11 – Position of pins in General Motors Corp. diesel head repair: A – repair made without removing the copper injector tube; B – repair made with the copper injector tube removed

Operation A on a General Motors Corp. diesel, as shown in Fig. 11, differs from the Cummins diesel in that the injector hole runs straight for about 5/16 in. Go straight down with the pin, from reasonably near to the insert to a depth of 7/16 in., as shown in operation A, Fig. 11.

Extreme care must be taken with these operations, as a drill through, or even the swelling of the copper injector tube, will make replacement necessary.

If the crack shows up below the valve insert, it will be necessary to remove the injector tube and make the repair, using operation B, Fig. 11.

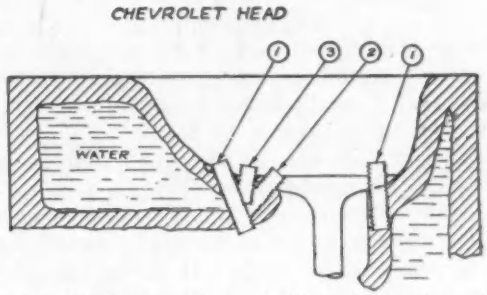
Use 3/16-in. special rod through the wall and use ⅛-in. special rod to come down through the top.

Measure the 3/16-in. pin and cut it so it will come through barely flush on the injector side, as any projection will interfere with the copper tube and must be ground off.

After completing the repairs, circulate sealing compound through the cooling system.

Each pin should be dipped in sealing compound before installing.

Chevrolet Heads – (See Fig. 12.)



■ Fig. 12 – Position of pins in Chevrolet head repair

The most common of the numerous types of Chevrolet heads is shown in Fig. 12, either in what is called the long or the short side.

On some models, a crack may occur close to the wall or rise and the repair can be made with one pin, as shown on the short side in Fig. 12.

If the crack occurs near the center of the port and extends down through the valve port, trace this for the end, using a reverse or dental mirror.

1. Channel through the valve seat and back to the end of the crack.

2. Drill a 5/32-in. hole through the channel from above, at a point where the drill will come through the end of the crack in the port underneath.

3. Tap and install pin No. 1, as shown on the long side in Fig. 12.

4. Drill for pin No. 2 through the valve seat into pin No. 1 and install pin No. 2, as per valve-seat instructions (see previous section *"L-Head-Type Valve-Seat Repair"*).

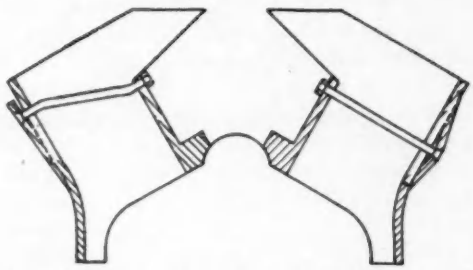
5. Install pin No. 3.

If the crack runs too far for three pins, continue with additional pins, as shown in Fig. 8. On the short side in the Chevrolet head, the crack runs straight down the wall of the valve port. On this operation, drill down the wall past the end of the crack. It is impossible to install this pin at a right angle with the valve seat, but as the combustion-chamber wall comes up behind it, the angle is unnecessary.

After completing the repairs, circulate sealing compound through the cooling system.

Each pin should be dipped in sealing compound before installing.

Outside Cracks in Ford V-8 – (See Fig. 13.)



■ Fig. 13 – Method of repairing outside cracks in Ford V-8

Outside freeze cracks in Ford V-8 occur generally at four points – between the exhaust ports on each side of the blocks at a point directly between the cylinders.

Sometimes the highest point in the bulge will be at the top of the block, and sometimes it is down about the middle.

If the bulge is at the top, the repair is made as follows:

1. Drill a 5/16-in. hole through the highest point of the bulge, which will usually be at the center of the star of line cracks caused by the bulge.

2. Drill a 5/16-in. hole on the valve-chamber side just far enough below the shoulder to allow for a nut.

3. Countersink the outside with a 45-deg countersink.

4. Measure from the top of the block down to the hole on the outside and also to the hole on the valve-chamber side, and bend the bolt to offset it, as shown on the left side in Fig. 13. Use No. 10-5/6 x 7-in. seal bolt.

5. Install the bolt and put a lead washer on the valve side. (If lead is not available, use a string of pump-packing material.) Put on a 5/16-in. hexagon nut. With a T wrench, start drawing up, tapping out the head of the bolt on the outside with a hammer as the bulge is pulled down.

6. When the bulge is drawn level, drill and pin the end of each crack, using 3/16-in. special rod – threaded 10-32.

For a low bulge, proceed as above – though the bolt can probably go straight through, with this operation, and will not have to be offset. (Right side, Fig. 13.)

This repair may be made absolutely invisible as follows:

1. Drill the outside 5/16 in. and the inside ¼ in.

2. Weld an extension on a 5/16-in. tap, and go through from the outside and tap the inside out to 5/16 in.

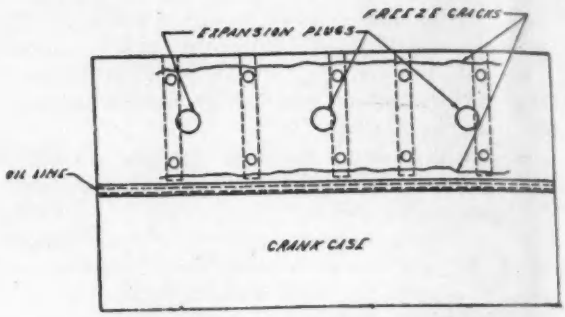
3. Put the seal bolt through and pull with a pair of vise-grip pliers.

4. When the outside is level, cut off the inside and peen.

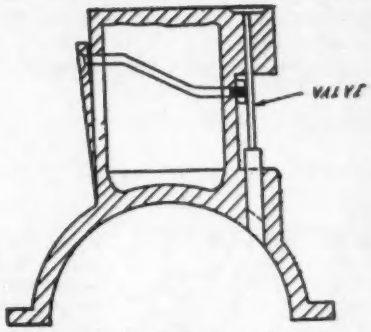
After completing the repairs, circulate sealing compound through the cooling system.

Each pin should be dipped in sealing compound before installing.

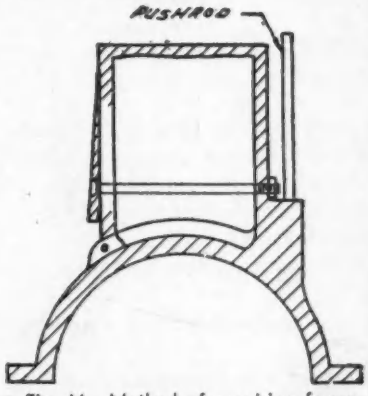
Common Freeze Cracks in L-Head and Overhead-Type Engines – (See Figs. 14, 15, and 16.)



■ Fig. 14 – Common freeze cracks in engine blocks



■ Fig. 15 – Method of repairing freeze cracks in L-head type engines



■ Fig. 16 – Method of repairing freeze cracks in valve-in-head type engines

Freeze cracks in engine blocks, as shown in Fig. 14, are repaired as shown in Fig. 15, L-head type, and Fig. 16, valve-in-head type.

The bolts used for this operation are referred to as seal members.

In some engines, the space between the cylinders will not permit the use of the No. 10-5/16-in., and it will be necessary to use the No. 12-¼-in.

Always begin near the end of the crack and work to the center. The number of bolts required depends on the location as well as the length of the crack, that is, a crack, 8 in. in length, may be located in such a manner that the center comes close to the space between the cylinders. One

bolt through the center will pull it in, whereas, if the center of the crack is in line with the center of a cylinder, it will be necessary to put a bolt through on each side of this cylinder.

For the L-head type, as shown in Fig. 15, proceed as follows:

1. Drill a hole, near the top and in line with the space between the cylinders, and countersink.

2. Drill through on the valve side far enough below the roof of the valve chamber to allow for the nut and washer.

3. Measure down from the top of the block on each side and bend the bolt to offset it, as shown in Fig. 15.

4. Insert the bolt and use a lead washer under the nut on the valve side. (If lead is not available, cut a washer from vellumoid and use under a steel washer with pump packing.)

5. Draw up with a wrench, beginning at the ends and tapping along the crack with a hammer as it is pulled in.

6. When drawn down in line, drill, tap, and screw in some special 3/16-in. dowel pins, being sure to place one exactly in each end of the crack. Space others from 1 to 2 in., according to the thickness of metal, as heavy or thick metal requires less pins.

For the valve-in-head type, as shown in Fig. 16, proceed as follows:

(Description is given for use of a No. 10-5/16-in. bolt. If necessary to use No. 12-¼-in. bolt, drill and tap accordingly.)

1. Drill a 9/32-in. hole through at the extreme bottom on the push-rod side of the block and in line with the space between the cylinders. Use a long drill and pull on through the other side at the desired spot it is wished to pull from, as shown in Fig. 16.

This bolt may be put through at a downward slant, if desired, as the crack usually occurs at the extreme bottom, which is somewhat lower than one can get through on the push-rod side.

2. Ream the hole on the crack side to 5/16 in. and countersink.

3. Tap to a 5/16-18 thread on the push-rod side, always using a long and extended tap and going through from the crack side to ensure perfect alignment.

4. Insert No. 10-5/16-in. seal member and pull in by using vise-grip pliers on the end coming through, tapping the crack side with a hammer as you draw and always working from the ends toward the center.

5. When lined up, cut the bolts off smooth on the push-rod side and peen.

6. Pin the crack with dowels, as described.

On blocks where the crack is at the bottom of the water jacket and that have been in service any length of time, it will be necessary to clean out thoroughly before the sealing compound will effect a repair.

This is best done by drilling a 13/32-in. hole in each end of the crack and inserting a piece back and forth, as water is flowed in from the top.

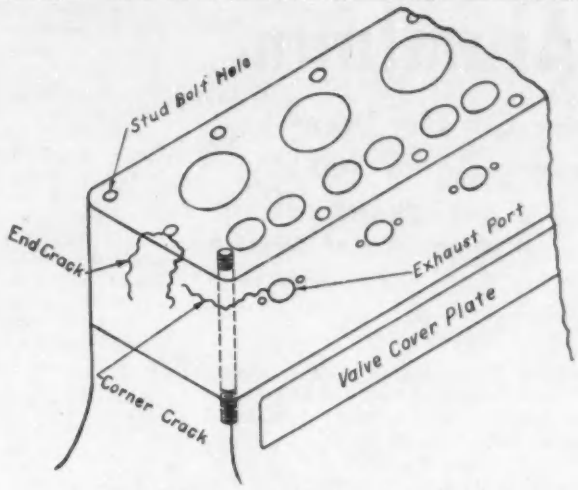
These holes will serve for the end pins and after the crack has been pulled down level, tap these holes and insert a ⅛-in. pin plug.

After completing the repairs, circulate sealing compound through the cooling system.

Each pin should be dipped in sealing compound before installing.

Freeze and Strain Cracks – (See Fig. 17.)

Freeze cracks, or strain cracks, located near and parallel to the top of the blocks have a tendency to open, as a result of the pull of cylinder-head bolts or studs.



■ Fig. 17 – Freeze and strain cracks in the block

In some types, the crack is caused by excessive pull on a stud and the crack opens up around the corner and into the exhaust port.

1. Pin the end of the crack and make a normal repair at the exhaust port.

2. Ream out the stud hole to the bottom of the water jacket, whether on the valve side or the other side.

3. Drill and tap for a long stud; this will transfer the pull from the top to the bottom of the block.

In some blocks, the expansion plugs can be removed, showing in the bottom just where to drill.

If the expansion plugs are not located so this can be done, drill a hole to see through, tap it, and install a pipe plug when finished.

On rare occasions, almost the entire end is broken out of a block by excessive pull on the studs, causing a crack between all of the end studs and at the corner of the block.

As the cylinder in these jobs is very close to the end of the block, it has been found advisable to double-sleeve.

This is done as follows:

1. Use a sleeve that is large enough to bore for the use of the sleeve required. Bore out and install this sleeve, and pin around both top and bottom by drilling as nearly as possible at right angles through the sleeve and into both top and bottom. Pin with four to six pins of 3/16-in. special rod.

2. The broken end of the block may be anchored to this sleeve, by tapping through from the outside and stay-bolting.

3. Bore out to the desired size and install the regular sleeve.

Some blocks have considerable space between the valves and the cylinder, and it has been found that, in sleeving, the old wall has been completely broken away from that top and the overhang caused by this will vibrate.

It will then be necessary to stay-bolt this overhang to a point below, at a point directly between the valves and as near the cylinder wall as possible, or it may be double-sleeved as described above.

After completing the repairs, circulate sealing compound through the cooling system.

Each pin should be dipped in sealing compound before installing.

Aluminum

May Cut Car Weight Approximately 500 Lb

by FRANK JARDINE
Aluminum Co. of America

▪ Detroit, May 17

(Excerpts from paper entitled "Aluminum Developments.")

ANY use of aluminum in post-war cars will have to be proved from both an economical standpoint and a practical standpoint.

Aluminum in automobiles has been suggested for practically everything but seat covers and inside trim in the past. The question of aluminum crankshafts has been suggested; also, aluminum poppet valves, valve springs, car springs and a great many other parts. Aluminum has been used in large quantities for bodies, crankcases, transmission cases, and other miscellaneous parts but discontinued in most instances due to cost.

In the past, weight-saving programs involved making a few of the major parts light, resulting in a saving of a few hundred pounds, which made very little difference in the car performance and was largely a matter of engineering department records. These small weight savings would be of very little real interest to a car owner because he couldn't notice any difference in performance, cost of car, or economy of operation.

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2-Engined Family Plane Visioned

by FRANK M. BONDOR
Civil Aeronautics Administration

▪ Kansas City, May 24

(Excerpts from paper entitled "Probable Trend of Post-War Aircraft Powerplant Installation Design.")

WE can expect to see the family airplane of the future a multiengined aircraft for the following reasons: (1) Safety; (2) Comfort; (3) Dependability; (4) Lower maintenance cost.

On the surface, it appears that the writer is taking sides on the eternal controversy, single-engine versus multiengine installations. This is not the case because he would be the first to go on record advocating single engine installations if only one of our many manufacturers of very good aircraft engines would guarantee without any reservation that his engine when installed in an aircraft according to his recommendations is guaranteed not to malfunction or fail, even after it is overhauled according to his recommendations, at the end of his specified service period, and if each part of the engine is retired from service at the end of his specified life expectancy period.

The engine manufacturer fully appreciates the following facts: First, it is practically impossible to obtain material for the engine with absolute assurance that it contains no hidden flaws and that the chemical analysis and physical properties of each batch are identical with every other batch; second, the engine manufacturer has no control over the conditions under which the aircraft is operated or over the owner of the aircraft. In the former case, the percentage of failures due to minute flaws in the material will constantly decrease as foundry practices, forging technique, and inspection equipment are improved. In the latter case, he is faced with the fact that the owners do not, as a rule, like to be burdened with a mass of details and controls, even if they are provided for their safety. All they want and expect is to go when they desire to, relax and enjoy themselves while going, and get back home in the minimum of time with the minimum of mental and physical effort and cost. Therefore, it can be expected that the majority of potential owners will demand the additional safety which multiengines permit.

Powerplant installation design trend is toward providing automatic controls for all the following items:

(a) Propeller with full feathering features
(b) Throttle
(c) Mixture
(d) Carburetor air heat
(e) Engine cooling
(f) Engine oil cooling
(g) Engine warming
(h) Engine oil dilution
(i) Automatic heating and ventilating of cabin
(j) Automatic engine accessories cooling

It can be expected that safety equipment in so far as the powerplant installation is concerned will include at least the following:

(a) Automatic fire warning device
(b) Fuel, oil, and hydraulic fluid shut-off valves on or behind the firewall
(c) Fire extinguishing fluid for the power and accessories section, or an installation that will isolate a fire and smother it
(d) Fool-proof fuel system
(e) Engine starter

Safety cannot be stressed too much, since the lack of it may offset all other points built into the aircraft to create the desire of ownership.

• Zinc-Plated Bolts Can Cause Exhaust Failure

by H. A. CAMPBELL
Solar Aircraft Co.

▪ Southern California, May 14

(Excerpts from paper entitled "Stainless Steels – Hot and Otherwise.")

THE industrial expansion of the last two years has seen fabrication of aircraft exhaust systems by many new manufacturers relatively inexperienced in this field. These fabricators, together with many newcomers to the aircraft industry as a whole, have been confronted by problems seeming to cause them great concern. These problems arise from the engineering applications of stainless steel to exhaust systems and have to do with (1) the comparative advantages of titanium- and columbium-stabilized 18-8 steel, (2) carbide precipitation effects, (3) welding of thin sheets, and (4) metallurgical effects of zinc-alloys on stainless.

The conditions of service to be met include severe vibrations in structures usually supported as interconnected cantilevers (in the case of the collector ring and some liquid-cooled in-line applications), or as cantilever tubes or shapes (in the case of stack-type exhausts). On engines of 1000 hp and more, temperatures of from 1000 F to 1700 F are found in these structures. Hot exhaust gases pass along the inside at relatively high velocities, while rain and sea atmosphere are frequent visitors on the outsides of the pipe system.

Under such service conditions it appears that titanium-stabilized 18-8 stainless meets all the requirements for most installations although there are some places where titanium-stabilized has failed and columbium-stabilized has done the job.

For the larger portion of designs titanium-stabilized (Type 321) steel does the job well although there are cases where columbium-stabilized (Type 347) steel is applied because of its higher values of yield and tensile strengths.

Carbide Precipitation

A few early failures of exhaust system parts were attributed to intergranular corrosion from carbide precipitation, and suggestions are heard still that present-day failures

are due to this same phenomenon. It would appear, however, that in material in which titanium is present to the extent of at least four times the carbon content, or in which columbium is present to the extent of at least eight times the carbon content and to which carbon has not been added during the processing of the product, there is little to fear from carbide precipitation leading to intergranular corrosion and subsequent failure of the part.

A stabilizing heat-treatment consisting of holding the material at 1550 to 1650 F for two hours, more or less, has been used where it is desired to establish the maximum possible resistance to intergranular corrosion in some specific media. In exhaust systems, however, this stabilizing heat-treatment appears to be unnecessary inasmuch as there seem to be no media encountered under service conditions so highly corrosive as to require the establishment of such maximum resistance.

Welding of Thin Sheets

Cracking of welds in thin stainless steel sheets such as are used for the fabrication of exhaust systems often becomes a very annoying problem, especially during the training of new welders. In an investigation of this subject, it was found that in addition to the ever-present variables of welding heat, flame adjustment, and fitting of the joint, the constitution of the welding flux itself plays an important part.

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Briefed from Papers Given at SAE SECTION MEETINGS

Fuels and Lubricants Specs For U. S. Army Ground Forces

by GEORGE A. ROUND
Technical Division, Office of the Chief of Ordnance.

▪ Pittsburgh, May 25

(Excerpts from paper entitled "Fuels and Lubricants for U. S. Army Motorized Ground Forces," which include the latest revisions of U. S. Army Specifications for gasoline, lubricating oil, universal gear lubricants, and greases. These revisions have been made since the presentation by Mr. Round of another paper bearing the same title, which was published in the SAE Transactions, Vol. 50, July, 1942, pp. 267-275.)

ARMY gasoline specifications are designated Motor Fuel (all-purpose) U. S. Army Specification 2-103A and Motor Fuel (72 octane) U. S. Army Specification No. 2-114.

To date, there has been no change in the 72-octane grade and none is contemplated. On the other hand, a number of changes have proved desirable in the all-purpose fuel.

As a result of test work, a number of changes have been recommended for adoption by the Army. These have not yet been officially adopted. However, the general nature of the proposed modifications can be mentioned, and the new specification is given in Appendix I.

First, the number of seasonal grades has been reduced from three to two, one intended for all summer service and winter use down to 0 F. The other is a winter gasoline for use primarily in extreme cold and at temperatures not to exceed 10 F. To make this possible, the volatility characteristics of the A and C grades have been changed materially and the permissible vapor pressure of the summer (A) grade is reduced from 8 lb to 7 lb.

Other changes include a confirmation of the limitation of lead content to 3 cc per gal, the adoption of an oxidation stability requirement to guard against trouble in long-time storage as is often required in military operations, and an increase in the permissible sulfur content to 0.25%.

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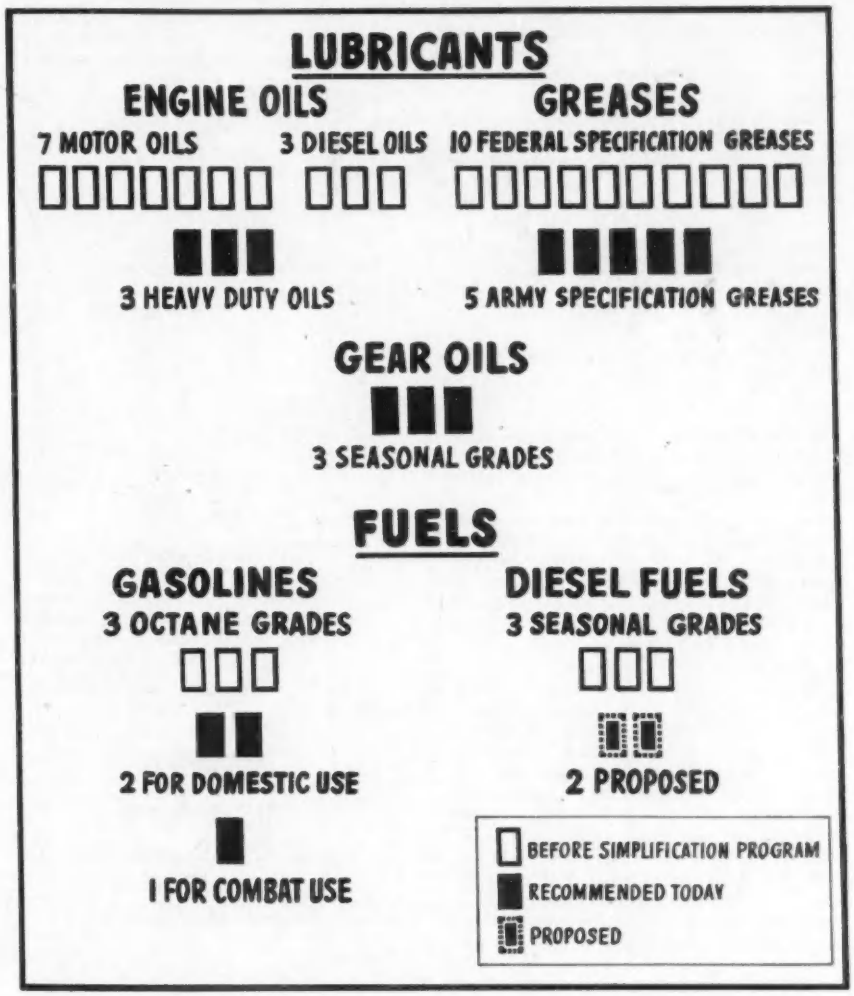
Fuels and Lubricants for Army Reduced



Important reductions in the number of fuels and lubricants required for military vehicles (shown in diagram at right) have resulted from an aggressive standardization and simplification program carried out by the Army.

The ideal of one fuel for all engines – and one lubricating oil for all engines and gears – has not been achieved, but this diagram shows that major progress has been made. The open squares indicate the number of fuels and oils in use by the Army before the start of the simplification program described by Mr. Round in the accompanying article – while the black squares show the number in use today

Lubricants – Engine Oils

During the past year, there have been a few minor changes in the specifications. The pour points on the 10 and 30 grades have been lowered to —10 F and 0 F, and a stipulation included for pour point of these two grades after dilution, as is required for extreme low-temperature service.

Some additional changes have been made: The inclusion of the 36-hr Chevrolet Engine Test as an added requirement for all three grades; and a new method is specified by which a supplier may show that the oil he proposes to offer under the specification meets the engine test requirement.

Until recently, an oil has been accepted if it was included on the approved lists of the Caterpillar Tractor Co. and the General Motors Corp. as having passed the Caterpillar-type tests and the GM Diesel 500-Hr Test. For the future, any new or changed oils will be required to be tested in a laboratory approved by the Ordnance Department, except that certain tests will be conducted only at Armour Research Foundation, Chicago. All oils now on the Army approved list will not be required to be tested again unless a change is made in their composition, either as to mineral stocks or amount or kind of additive used. The latest specification, condensed, is shown in Appendix II.

Heavy-Duty Oils

To date, the results with heavy-duty oils have been quite satsfactory and comparable with those obtained in civilian service. Engines have been notably cleaner, ring and valve gumming are not reported, bearing corrosion troubles have disappeared, and, when the stipulated procedure was followed, there was no difficulty in changing from ordinary to heavy-duty oils.

Present Gear Lubrication Problems

As a result of field experience during the past year, it was learned that any gear oil heavier than SAE 90 was not required, even for desert temperatures. It was also concluded that the emulsion requirement of Federal Specification VV-L-761 was unnecessary, and in fact undesirable, since to meet it, oils that would not absorb moisture accumulating in gear cases had to be used. This tended to permit gear and bearing rusting under some conditions.

To meet the latter condition, a revision of VV-L-761 took effect Sept. 1, 1942, the emulsion requirement being eliminated. Since practically all other petroleum products used by the Army Ground Forces are purchased under Army rather than Federal Specifications, it was also decided to issue one covering Universal Gear Oil. This is Ordnance Department, U. S. Army Tentative Specification AXS-825, dated Nov. 17, 1942. It included grades 80, 90, and 80-90, a special high-viscosity index product and was, in fact, identical with VV-L-761 in all essential details. It is given in Appendix III.

More recent developments appear to indicate that vehicles can be operated satisfactorily in hot weather with the 80 grade and that heavier oils are unnecessary. Experience this past winter has also shown that for extremely low temperatures, a lighter oil than the present 80 grade is required, the practice of diluting the 80 grade with gasoline, kerosene, or diesel fuel being impracticable except as an emergency measure. It may be stated that the present trend is toward a single gear oil – grade 80 – for all normal summer and winter service down to zero or —10 F, and a special very light grade for use in those areas where winter temperatures may reach —50 or —60 F and will not go much above 10 to 15 F. As yet, this program has not been concluded, and the 90 grade is being recommended for summer service above 32 F.

Chassis Lubrication

In this paper as originally published, Army Specifications for five grades of grease were shown in the appendix. Products procured under these specifications have worked well generally, but experience has shown the need for a number of improvements. In the case of the winter chassis grease, the viscosity of the mineral oil has been reduced and a limit set for this at zero and soda-base greases excluded in this grade. A pour test limit has also been introduced. These changes improve pumpability and distribution at low temperature.

In the case of the wheel bearing grease, the viscosity requirement was modified to assure better low-temperature operation.

The specifications as revised are given in Appendix IV.

Appendix I

MOTOR FUEL (ALL-PURPOSE)

U. S. Army Specification No. 2-103B April 8, 1943

E. Detailed Requirements

E-1. Motor fuel shall be of one grade and two types with automatic provisions for locality and climatic conditions, and shall conform to the following requirements:

	Classification	
ASTM Distillation:	**A**	**C**
10% evaporation, F	**140-158**	**122 (max.)**
50% evaporation, F (max.)	**221**	**203**
90% evaporation, F (max.)	**329**	**302**
Residue, % max.	**2**	**2**
Vapor Pressure, psi, max. (a)	**7**	**12**
Octane No., ASTM, min.	**80**	**80**
Gum, mg/100ml, max. (b)	**7**	**7**
Sulfur, %, max.	**0.25**	**0.25**
Corrosion	**None**	**None**
Tel Content, cc/gal (max.)	**3**	**3**
Oxidation Stability (max.)	**2 lb drop in 7½ hr**	**2 lb drop in 7½ hr**

(a) When vapor pressure measurements are made on samples taken at the refinery or from tank cars, barges, or bulk storage, an additional 1 psi in vapor pressure shall be allowed, except that no increase in vapor pressure shall be permitted when the motor fuel is for use in tropical areas (23½ deg north latitude to 23½ deg south latitude).

(b) When a finished gasoline contains a non-volatile additive, it shall be permissible to make the gum test on the base stock.

E-2. The color of the fuel shall be red and substantially equal in color intensity to that obtained by the addition of 2 g of red dye (equivalent to International Color Index No. 258) per 100 U. S. gal of white gasoline (26 + color).

E-3. The class of motor fuel to be supplied in any locality at any one season of the year shall conform to the following tabulation, and each contractor shall automatically make seasonal modifications in accordance with this tabulation:

Territory	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Section 1	C or A	C or A	C or A	A	A	A	A	A	A	A	A	C or A
Section 2	C or A	C or A	A	A	A	A	A	A	A	A	A	A
Section 3	A	A	A	A	A	A	A	A	A	A	A	A
Section 4	A	A	A	A	A	A	A	A	A	A	A	A

Section 1	*Section 2*		*Section 3*	*Section 4*
Idaho	Colorado	Nebraska	Alabama	Arizona[b]
Iowa	Connecticut	Nevada	Arizona[a]	Florida
Maine	Delaware	New Jersey	Arkansas	Louisiana
Michigan	District of Columbia	New York	California	New Mexico[b]
Minnesota	Illinois	Ohio	Georgia	Texas[b]
Montana	Indiana	Oregon	Mississippi	
New Hampshire	Kansas	Pennsylvania	New Mexico[a]	
North Dakota	Kentucky	Rhode Island	North Carolina	
South Dakota	Maryland	Utah	Oklahoma	
Vermont	Massachusetts	Virginia	South Carolina	
Wisconsin	Missouri	Washington	Tennessee	
Wyoming		West Virginia	Texas[a]	

[a] North of 33-deg latitude.
[b] South of 33-deg latitude.

A temperature guide for grade A and C where the above zoning does not apply:
A – For mean temperature from 0 F to extreme heat.
C – For mean temperature from extreme cold to 10 F.

E-4. A tolerance of one week, plus or minus, will be permitted on delivery of the seasonal grades as specified in paragraph E-3.

Appendix II

OIL, ENGINE

U. S. Army Specification No. 2-104B (Condensed) Revision May 6, 1943

B. Grades

B-1. Engine oil shall be of three viscosity grades designated as SAE 10, SAE 30, and SAE 50.

C. Material and Workmanship

C-1. Engine oil shall be a refined petroleum product with or without additive agents.

D. General Requirements

D-1. Engine oil shall be non-corrosive to bearings and engine parts, shall not cause or permit piston-ring sticking or clogging of

Test	Test Limits		
	Grade SAE 10	Grade SAE 30	Grade SAE 50
Viscosity, S. U. Sec at 130 F	90 to less than 120	185 to less than 255	....
Sec at 210 F	....	....	95 to less than 105
V. I., min.	85	55	75
Pour Point, F, max.	−10	0	15
Pour Point after dilution with 20% Precipitation Naphtha, F, max.	−40	−40	....
Flash Point, F, min.	360	390	400

Table I

oil channels and shall minimize cylinder and ring wear. This engine oil shall provide satisfactory lubrication of high-speed, automotive-type gasoline, diesel, or spark-ignition fuel engines when operated under all conditions of service. Additive agents, if used, shall not appreciably increase the tendency of the base oil to foam.

D-2. Additive agents, if used, shall remain uniformly distributed throughout the oil at all temperatures above the pour point up to 250 F. If the oil is cooled below its pour point, it shall regain its homogeneity on standing at a temperature of not more than 10 F above the pour point of the oil.

E. Detail Requirements

E-1. Qualification. Engine oils furnished under this specification shall be of a grade or grades which have been tested and found suitable for the purpose intended as determined by the "Qualification" tests in section F (see paragraph H-1).

E-2. Engine oils covered by this specification shall be in accordance with Table I.

E-3. Flash Point. The minimum flash point of Grade SAE 50 before the addition of any additive shall be 450 F.

E-4. Control Limits. For purposes of product identification, the bidder shall state in his bid the suitable control limits of the oil he proposes to furnish, as regards the following:

Gravity, API
Carbon Residue, %
Sulfur, %
Phosphorus, %
Chlorine, %
Ash, %

Components of Ash, %, and such other tests as he may consider desirable for identification purposes.

F. Methods of Sampling, Inspection, and Tests

F-3. Qualification tests. All engine oil procured under this specification shall be tested for qualification as follows:

F-3a. Unless otherwise specified, the qualification tests shall be made in accordance with Table III (see paragraph H-1):

Table III

Required when the finished engine oil uses an additive not previously used in an engine oil qualified by the Ordnance Department.

SAE 10 Grade
1. CRC-Designation-L-4-243
2. CRC-Designation-L-1-243
3. CRC-Designation-L-2-243
4. CRC-Designation-L-3-243

SAE 30 Grade
1. CRC-Designation-L-5-243
2. CRC-Designation-L-4-243
3. CRC-Designation-L-1-243
4. CRC-Designation-L-2-243
5. CRC-Designation-L-3-243

SAE 50 Grade
1. CRC-Designation-L-4-243

Required when the finished engine oil uses an additive previously used in an engine oil qualified by the Ordnance Department.

SAE 10 Grade
1. CRC-Designation-L-4-243
2. CRC-Designation-L-1-243
3. CRC-Designation-L-2-243

SAE 30 Grade
1. CRC-Designation-L-4-243
2. CRC-Designation-L-1-243
3. CRC-Designation-L-2-243

SAE 50 Grade
1. CRC-Designation-L-4-243

Note: CRC Designation L-4-243 is essentially the 36-Hr Chevrolet engine test. CRC Designation L-1-243 is essentially the 480-Hr Single Cylinder Caterpillar Diesel Engine Endurance Test. CRC Designation L-2-243 is essentially the Single Cylinder Caterpillar Diesel Engine "Scratch" Test. CRC Designation L-3-243 is essentially the 4-Cylinder Caterpillar Diesel 120-Hr Stability and Bearing Corrosion Test. CRC Designation L-5 is essentially the GMC Diesel 500-Hr test.

Appendix III

LUBRICANT, GEAR, UNIVERSAL (HYPOID AND OTHER TYPES)

Ordnance Department

U. S. Army Tentative Specification AXS-825* (Condensed) Nov. 17, 1942

C. Material and Workmanship

C-1. Universal gear lubricant shall consist of a mixture of well-refined mineral oil and a load-carrying additive containing sulfur and chlorine, with or without the admixture of other additives.

C-2. Universal gear lubricant shall be satisfactory for the lubrication of all automotive gear units (hypoid or other types), all heavy-duty industrial-type enclosed gear units, steering columns, and fluid lubricated universal joints of automotive equipment, where the sustained operating temperatures of the lubricant are 250 F or lower.

D. General Requirements

D-1. Universal gear lubricant shall be homogeneous liquids, free from sediment and suspended matter, and shall remain without turbidity at any temperature in the operating range up to 250 F.

D-2. Universal gear lubricants supplied by different, or the same, manufacturers shall meet the detailed requirements of this specification when mixed in any proportions.

D-3. Universal gear lubricants shall contain only those additives in fixed percentages which have been subject to type tests for solubility, emulsion, effect of rate of shear, and endurance by the National Bureau of Standards or a laboratory approved by them, with the sole exception that materials whose only function is to lower the pour point will not be considered as additives for purposes of this specification.

E. Detail Requirements

E-1. Universal gear lubricants shall conform to the following requirements:

Test	Test Limits		
	SAE 80	SAE 90	SAE 80-90
Viscosity, S.U., sec at 210 F	55-65	80-90	80-90
V. I., Dean & Davis, min.	85	85	110
Channel Test, F, max.	−30	0	−30
Load-Carrying Capacity, lb, min.			
Before Heating, 1000 rpm	300	325	325
After Heating, 500 rpm	400	400	400
Shock Test	Pass	Pass	Pass
Stability Test (100 hr at 300 F)			
Viscosity Increase, %, max.	25	25	25
Insoluble Material, %, max.	0.5	0.5	0.5
Evaporation Loss, %, max.	10	10	10
Corrosion Tests			
1 hr at 212 F, Copper Strip	Negative	Negative	Negative
1 hr at 300 F, Copper Strip	Positive	Positive	Positive
24 hr at 200 F, Steel Strip, g, max.	0.01	0.01	0.01
Foaming Test, ml, max.	150	150	150
Turbidity	None	None	None

* The technical requirements of this specification conform in all respects with the requirements of the draft dated Sept. 1, 1942 of proposed Federal Specification VV-L-761.

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Zinc-Plated Bolts Can Cause Exhaust Failure

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Metallurgical Effects of Zinc Alloys on Stainless

In the course of the cracking investigation mentioned, it was discovered that bits of zinc alloy from drop hammer dies could also produce cracks in stainless during the annealing or other heating operation if the bits of zinc were allowed to remain on the metal surface. The die-casting industry has known for some time that zinc alloys will dissolve the iron of the melting pot. It was thought, however, that cracking of this sort had been confined to the factory, but several failures in the field showed otherwise, and there appeared to be cause for some alarm when it was decided recently by national production authorities to substitute zinc for cadmium plating on aircraft bolts, many of which are used in exhaust systems. In view of the evidence developed with the cooperation of manufacturers and others, it is hoped that the use of cadmium for such bolts will be ordered in the near future as it is possible that an exhaust system may fail because of the presence of zinc, thereby putting an aircraft out of service.

Appendix IV

CONDENSED SUMMARY OF ARMY SPECIFICATIONS FOR GREASES

Nov. 30, 1942

Detail Characteristics					
Grade No.	0	1	2	Water Pump	Heavy-Duty Wheel Bearing
Army Specification No.	2–106	2–107	2–108	2–109	2–110
Worked Penetration at 77 F	355–385	310–340	265–295	175–205	220–250
Oil Content, min., %	90.0	85.0	82.0	65.0	70.0
Water Content, max., %	1.5	2.0	1.5	2.5	Trace
Ash as Sulfates, max., %	3.5	3.5	6.0	8.0	7.5
Free Alkali (as NaOH), max., %	0.2	0.2	0.5	0.2	0.5
Insoluble Matter, max., %	0.10	0.10	0.10	0.10	0.10
*Free Fatty Acids (as oleic), max., %	0.30	0.30	0.30	..	0.3
Dropping Point, min., F	..	..	250	210	300
Corrosion	Nil	Nil	Nil	Nil	Nil
Mineral Oil					
Viscosity at 0 F, max., sec	75,000	..	..	..	..
Viscosity at 100 F, min., sec	275	750	..	100	..
Viscosity at 100 F, max., sec	325	..	..	..	..
Viscosity at 210 F, min., sec	..	..	75	..	75
Viscosity at 210 F, max., sec	..	..	100	..	..
Pour Point, max., F	—15	..	25	..	..
Flash Point, min., F	350	350	350	315	350
Soap, Type of	Note 1	Note 2	Note 3	Note 4	Note 5
Fillers	None	None	None	None	None

* Omit determination if aluminum soap is present.

Note 1. Base shall be a calcium and/or aluminum soap of one or more of the higher fatty acids.

Note 2. Base shall be a sodium and/or calcium and/or aluminum soap of one or more of the higher fatty acids.

Note 3. Base shall be a sodium and/or calcium soap of one or more of the higher fatty acids.

Note 4. Base shall be a calcium soap of one or more of the higher fatty acids.

Note 5. Base shall be a sodium and/or calcium and/or barium soap of one or more of the higher fatty acids.

Aluminum May Cut Car Weight 500 Lb

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In order to interest an owner, there should be a weight saving great enough to be noticeable in performance or economy or both. Any weight-saving program involving the use of approximately 500 lb of aluminum per car would have been impossible before the war, but under post-war conditions such a program can be taken care of without any difficulty.

To provide sufficient aluminum to take care of the war needs, it has been necessary to build a large number of plants for the production of this metal, and also plants for fabrication. After the war these plants will be in a position to produce and fabricate larger quantities of aluminum more efficiently than ever before for the automobile trade.

Increased Production

By the end of 1943 aluminum ingot production capacity should reach approximately 2,100,000,000 lb as compared to 327,000,000 lb in 1939, or 6½ times the amount produced for pre-war use. This enormous increase in production has resulted in a 25% reduction in price within the last few years. While the production of aluminum was being increased in the United States, the production of aluminum all over the world has been increased proportionately. After the war aluminum will be available for everything in large quantities, the price should be stable, and the quantities of both primary and secondary metal available, practically unlimited.

Secondary alloys are increasing very rapidly in quantity available and in proportion to the available primary metal. The quality of these secondary alloys is far superior to the secondary alloys available before the war. These changes in quantity and quality make it possible to use secondary alloys for automobile engine cylinder heads, crankcases and cylinder blocks, transmission cases, and many other castings. The price of this material after the war should be low enough to make it economically practical to use it in large quantities.

30% Weight Reduction Foreseen

It should be possible to reduce the weight of the standard 1942 cars 30% by completely redesigning the car to have an overall weight of 30% less than previous cars. Each unit should be designed for a given weight car and should take advantage of every weight saving possible. It is estimated 50% of this weight reduction would be obtained by the use of aluminum on the basis that one pound of aluminum used will mean a pound of car weight saved. The remaining 50% reduction should be accomplished by more economical design of the ferrous metal parts, and major parts could be made smaller and lighter for the lighter car.

Cost No Higher

Aluminum castings, and most of the other aluminum parts used in the past have been purchased in such small quantities that the fabricating cost has been high and based on job shop practice. The cost of making aluminum castings should not be much different than the cost of making the same part in iron in the same quantities, provided the part was designed for aluminum. In order to take advantage of the possibilities of large production of aluminum it would be necessary for automobile companies to make their own aluminum castings in their own foundries.

The most logical place to start saving weight is on the heaviest units such as the powerplant assembly, where approximately 225 lb can be saved in the weight of the average six-cylinder powerplant by use of aluminum cylinder block and crankcase, cylinder head, pistons, rods, intake manifold, transmission case and covers. The average car doors could be made approximately 30 lb lighter per door, bumpers 40 lb lighter, miscellaneous hardware 18 lb lighter, rear deck 18 lb lighter, hood assembly 34 lb lighter, wheels 45 lb lighter, shock absorber 5 lb each lighter, and weight saving in a number of other miscellaneous parts would add up to approximately 500 lb of aluminum parts, 200 lb of which would be secondary alloy castings and competitive with cast iron, 15 lb primary castings, 20 lb forgings, 20 lb die castings, and 270 lb stampings.

Generous Dimensions for Castings

Most engineers when designing for aluminum have light weight uppermost in their minds and the general tendency is to hold the sections as thin as seems possible. Parts designed under these conditions result in light parts, but as a rule they are very hard to make and the foundry scrap is high. A 50% weight saving should be enough and designers should use generous dimensions for their aluminum castings which will result in good production and low scrap loss.

If aluminum parts are carefully designed so they can be made by the most economical method in a well-equipped foundry, in large quantities, without excessive scrap losses—which are usually caused by poor design—they will cost less than ever before.

Comparative Tests on 9400 Series Steels

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4. Dynamometer Tests on SPIRAL-BEVEL GEARS OF 9420 STEEL

Submitted by Timken-Detroit Axle Co.

A COMPLETE axle in a cradle mounting is placed on the dynamometer. An arm, rigidly connected to the housing and attached to a weighing scale prevents rotation and provides a means of measuring output torque. The input load at the pinion is by a 125-hp d-c variable-speed, cradle dynamometer. The load is absorbed by two electric generators hooked up, through step-up gearing, to the axle shafts, one to each shaft, the current generated being dissipated through controlled resistance. The axle is operated as follows until failure or until it has passed our maximum requirements.

Pinion input	997.8 ft-lb torque
Pinion Speed	346 rpm
Axle Shaft Torque	10,245 ft-lb
Gear Tangential Pressure	20,490 ft-lb

The gears are 12⅞ pitch diameter, 6-40 ratio, formate cut and the type used in a 1½-ton truck.

On the basis of some 15 years of testing a minimum requirement of 100,000 cycles, at the above load, has been established for this gear set.

Six tests on gears made of NE 9420 show the following:

No. 1	166,080	No failure
No. 2	35,292	Pinion failed
No. 3	20,760	Pinion failed
No. 4	166,080	No failure
No. 5	92,382	Bearing failure
No. 6	20,760	Pinion failure
Average	83,559	

160,000 cycles or approximately 8 hr running is considered excellent. It is not known how long tests Nos. 1 and 4 would have run, as they were taken off in good condition after 8 hr. Test No. 5 was removed on account of a bearing failure with gear and pinion in good condition. These three tests might have raised the average considerably. No reason could be found as to why the tests Nos. 3 and 6 showed short life. None of the gears or pinions showed metallurgical defects.

It is believed that these gears can be recommended as meeting the minimum requirements. Further testing is being done.

5. Test on WHEEL STUDS (Conducted at Budd Wheel Co.)

Submitted by Timken-Detroit Axle Co.

A SET of 10 studs made of NE 9437 heat treated to a hardness of 250 Brinell have passed the 1,000,000 cycle point and are still running on a special fatigue test. Considerable significance can be placed upon these results as these studs were originally made of SAE 2320.

6. Tests of 8600 AND 9400 SERIES STEELS

Submitted by H. B. KNOWLTON, International Harvester Co.

THERE has been little or no quantity production applications of these steels as yet. Consequently, there is no report on machinability or any difficulties to be expected in regular production.

Preliminary laboratory tests have been run by Mr. Jameson at West Pullman Works. His results have been published in the following articles:

March 7 and March 15 *Steel*
March 15 *Iron Age*

Dynamometer tests on gears have been made in both the Truck and Tractor Divisions. Torsion fatigue tests on axle shafts have been made in the Tractor Division. In general, it may be stated that NE 9420 steels proved to be equal or superior to AISI 4120 in the dynamometer test on five-pitch tractor gears. They apparently were somewhat inferior to SAE 4820. In the truck tests NE 9420 again was found to be inferior to SAE 4820 but, in the main, was satisfactory and as good as SAE 4125 or SAE 4032, except for low-speed gears and universal joint crosses. In other words, NE 9420 will probably work out satisfactorily for most of the transmission gears but may not be satisfactory for differential gears, pinions, and universal joint crosses.

A very severe clashing test was made on tractor gears. The NE 9420 gears show better resistance to clashing than either NE 8620 or AISI 4120. All gears in this test were carburized, cooled, re-heated to 1600 F, quenched in oil, and given a low draw.

Fatigue tests on NE 9442 and NE 9445 steels have indicated that they are at least as good and probably somewhat superior to SAE 4140 in torsion fatigue. The tests were made on axles having spline diameter of 2.75 in., in the splined sections. In general, it was found that NE 8744, NE 8245, NE 9440-9445 all gave results at least as good as SAE 4140 in torsion fatigue. On the other hand NE 8442 and some other manganese molybdenum steels consistently gave results which were inferior to SAE 4140.

The following data tables summarize the results of some of the more important tests:

Table 1 – Summary of Dynamometer Tests 5-Pitch Transmission Gears

	Max. Stress for 400,000 Cycles, psi	Max. Stress for 1,000,000 Cycles, psi	Max. Stress for 10,000,000 Cycles, psi (Endurance Limit)
SAE 4820	100,000	94,000	80,000
NE 8620	100,000	91,000	75,000
NE 9420	95,000	89,000	75,000
SAE 4119	92,000	87,000	70,000
NE 8124	87,000	79,000	60,000
NE 9420 Trtd.	100,000	.....	.....

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Data on Test Gears

Pitch	5
Pressure Angle	20 deg
Addendum	Std.
No. of Teeth	15
No. of Teeth – Mating Gear	25
Width of Face	9/16 in

Heat Treatment

Carburize	1700 F
Cool	
Reheat	1600 F
Quench in Oil	
Draw at	380 F
Shot Blast	

Note: Particular attention is called to the fact that the results of these tests are reported in terms of maximum stress which can be withstood for a given number of cycles of operation. It will be noted on this basis that there is only 13% difference among all of the steels tested. It seems to be more customary to run all tests at the same stress and count the number of cycles. This method gives a very wide spread of results, the variation being as much as 2 or 3 to 1 and even using the same type of steel. Consequently it is difficult to get any comparative figures between steels without running a large number of tests. We have found the error much smaller when we work on the basis of determining a maximum stress for a given number of cycles.

Table 2 – Four-Square and Chassis Dynamometer Tests Truck Gears

Gear	Type of Test: Machine	Type of Test: Loading	Comparison With Other Steels
Trans. Low Speed Sliding Gear 6-7 P 20-deg P.A.	4 Square	Constant Load	NE 9420 inferior to SAE 4125 and SAE 4032. Average 9 hr as compared with 37 and 42 hr.
Trans. Low Speed Sliding Gear 6-7 P 20-deg P.A.	Chassis Dynamometer	Impact	1 Test NE 9420 equivalent to minimum for SAE 4620 and SAE 4032.
Rear Axle Ring Gear 3.156P 20-deg P.A.	Chassis Dynamometer	Impact	3 Tests NE 9420 superior to SAE 4125 and SAE 4032.
Rear Axle-Differential Gear Side Gear 5P 22½-deg P.A.	Chassis Dynamometer	Impact	3 Tests NE 9420 inferior to SAE 4032 and 2516. Results very erratic – 1 test very high; two very low.
Rear Axle Pinion Gear 3.156 P 20-deg P.A.	Chassis Dynamometer	Full-Throttle Constant-Load	3 Tests NE 9420 equivalent to SAE 4032 but inferior to SAE 4815.
Universal Joint Cross	Chasis Dynamometer	Impact	2 Tests NE 9420 inferior to SAE 4023 and SAE 3115.

SAE Coming Events

Aug. 19-20 SAE West Coast Transportation and Maintenance Meeting
Palace Hotel – San Francisco
(Auspices of four West Coast Sections.)

Sept. 23-24 SAE National Tractor Meeting
Schroeder Hotel – Milwaukee

Sept. 30-Oct. 2 SAE National Aircraft Engineering and Production Meeting and Engineering Display
Biltmore Hotel – Los Angeles

Nov. 4-5 SAE National Fuels and Lubricants Meeting
Mayo Hotel – Tulsa

Jan. 10-14, 1944 SAE Annual Meeting and Engineering Display
Book-Cadillac Hotel – Detroit

On the SAE Battlefronts

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ment is best. The designer and builder of these mechanized warfare vehicles could not make his voice heard against the newspaper and radio of a year ago, but the records are speaking for themselves today in the air and on the ground.

The untiring efforts of our 250 committees working with other agencies are difficult of evaluation in these rapidly changing times. An engineering effort which eased a crisis last year may be taken as today's commonplace; yet it is obvious that these efforts constitute patriotic services of which SAE justifiably can be proud.

There have occurred along the SAE battlefronts the Casablancas – the annual meeting and other momentous occasions – but instead of starting in Africa or the Solomons, they may have been started or decided by a relatively inconspicuous engineering group which solved a technical problem, developed a substitute material, or designed a tank or truck or gun which, in quality and quantity, has played a part in putting the technical edge on enemy equipment.

These committee assignments, so successfully worked out, will go far toward obtaining and holding that technical edge.

In passing, one should not overlook the work along the battlefront of the various Society activities – the technical meetings we have held, out of which have come outstanding technical papers and reports that have added many notches in our guns, or stickers on our fuselages.

To keep these battlefronts moving has taxed our Society's treasury, just as our Government's resources have been strained. War bonds might be likened to new membership dues – not much individually, but collectively a very sizable figure; while our War Chest might be considered as a large industrial loan. We have been able to retain the SAE battlefront on a sound financial basis. A great deal of the credit for this is due to the members who serve on the War Chest Committee and the companies that have contributed.

■ SAE on Firing Line

Our battlefront has had its personnel problems. We have had members go from industry to the services. It is with a deep feeling of pride that we read of the accomplishment of SAE men on the firing lines of the battlefronts of the world. Our efforts on the home front are not conscripted but, of course, are voluntary, and again this democratic method of solving our own problems is showing the weakness of the basis on which our enemies have built up their battlefronts. It is extremely unwise to prophesy on the end of the war or post-war trends or designs, but as one keen observer has stated, "When we can secure a 10% technical edge on our enemy, the war will be over."

Our members will have helped to obtain this technical position working in the mammoth plants now acting as the arsenal for democracy. These same men will be on the reconstruction front of tomorrow and will be the spark plugs of industrial and national prosperity when victory is attained. Let us do our part when that day comes in preserving a strong military policing program and the right to run our own battlefronts of industry.

Field Modifications of Ordnance Vehicles

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radically from other procurements, due to the fact that in many cases these parts are different from those used in production and are not included in existing production programs. The relative size of such orders is smaller, and as a consequence special attention is necessary. Therefore another duty of the Modification Section is to follow up and expedite such procurement, making certain that the material is available at the earliest possible date. The Field Service Modification Work Order itself is not published until at least a portion of the material does become available. Arrangements have been set up to keep a constant check on the status of every procurement.

The Manufacturing Branch of the Tank-Automotive Center and the Ordnance Districts give these procurements a high priority, and in some cases assign this work to certain personnel. When instituting the procurement of modification parts, it is necessary to choose the manufacturer with care, depending on his facilities, and to make certain of the time it will take him to make delivery. A general policy is followed of combining in kits all the parts for modifications. A package will contain all of the parts necessary for modifying one vehicle. In many cases, the package itself contains installation instructions.

■ Centralized Warehouse

The matter of storage next comes up. It has been found advisable to have a centralized warehouse where all modification material is stored. It might be said that a central warehouse could cause some duplication of transportation facilities, and that might possibly be true. However, the advantages of storing all modification parts in one warehouse and distributing them from that point far outweigh any objection of this nature.

The matter of distribution or issue of modification material presents something of a problem. In the first place, delay must be avoided because the work performed is necessarily of a vital nature or the modification would not have been initiated in the first place.

In making distribution, the available supply of material has to be definitely known and taken into consideration. It is natural that certain military organizations should have a higher priority than others, depending on their nature and the need for their services. The Modification Section must, therefore, determine who should be taken care of first. This matter of priority is covered by orders from higher authority and by the general priority system covering military organizations which now exist. It can readily be seen that this matter of distribution and issue is of the utmost importance or the original purpose of the modification may not be attained. One of the easiest ways to defeat the purpose would be to modify equipment which is not going to be used and then not have available material to take care of other equipment which will shortly be used.

Then, when a Field Service Modification Work Order is published and mailed to every using organization – posts, camps, stations, and other military set-ups – the user can initiate a requisition as instructed in the modification work order and the material will be sent.

However, another problem presents itself, and that is the matter of installation on the vehicle. In a great many cases, special programs have to be instituted to get this done. The matter of location of the equipment has to be checked and care has to be taken to see that every point is covered. Sometimes it is necessary to give special training to field personnel on the installation of modification parts. In this work the representatives of the manufacturers have performed a very valuable service. They have worked with Ordnance personnel in giving the necessary training and in the actual work of installation, where necessary.

It has, however, been found necessary for the Modification Section to have officers who are available for any assignment essential for the completion of the installation of modification. They travel among the posts, camps, and stations and coordinate the work of installing modification parts. They also make certain that all work orders are properly applied and that the modification of certain vehicles at some point has not been overlooked. In cases where using organizations have had difficulty in procuring material, they step into the picture and stamp out any such difficulty or misunderstanding. If an emergency arises where a certain quantity of equipment must be modified immediately for some special purpose, one of the members of this group is sent to the point in question and personally sees to it that the parts are received and the work done.

Another function of the Modification Section is the maintaining of records regarding the progress of Field Service Modification Work Orders now in force. A system of reports has been instituted whereby each Service Command periodically reports the number of vehicles on each modification that has been completed. When equipment is transferred from one organization to another, it is necessary to make sure that this equipment is not neglected. By means of these reports such cases are taken care of. By knowing in the beginning the number of vehicles to be covered by a certain modification, it is possible to determine when they have all been completed, and the work order can then be canceled.

■ Field Inspection Service

The Modification Section avails itself of the services of another section in the Maintenance Branch – the Field Inspection Section. These men have a complete list of the modification work orders and full information, and as they cover their territory one of their duties is to check up on this activity. Their reports are very valuable in determining what has or has not been accomplished.

We have now followed the field service modification procedure from beginning to end. It will be noted that this is a specialized activity and that it includes activities of nearly every type included in the Ordnance Department. In order successfully to bring it to a conclusion many outside contacts are vitally necessary, such as those with higher authority of the Army, with the manufacturer of the equipment, with the Engineering Branch of the Tank-Automotive Center, and above all with the using organizations.

It is the object of the Modification Section to determine as soon as possible the necessity for any improvement or change in equipment in the field or the needs of the using organizations, and then try to make these changes or improvements as soon as possible.

News.. ..OF THE SOCIETY

British Seek Coordination With U. S. Aero Standards

Representatives of the Society of British Aircraft Constructors, the Ministry of Aircraft Production and representatives of the Aeronautics Division of the SAE Standards Committee met at American Airlines, La Guardia Field, New York, on June 4 to discuss the possibility of coordinating American and British standards activities.

Prior to this meeting the British representatives had visited other American groups interested in aircraft standards, and met with the National Aircraft Standards Committee during their visit on the Pacific Coast. They also visited various aeronautical engineers in a variety of plants throughout the country.

At this meeting the SAE methods of procedure were outlined to the British, and the British representatives, in describing their methods of operation in this field, brought out the very close relationship which exists between the British Government and British aeronautical industry in these particular operations. A representative of the Ministry of Aircraft Production attends all the meetings of the standardization groups of the Society of British Aircraft Constructors. The SBAC actually operates the standardization work. It produces the designs for standard aircraft parts, and due to their participation in the evolution of the standards, it is possible for the Ministry immediately to approve the standards when they are completed.

As a result of this meeting arrangements were completed for interchange of all data and progress of various standards projects between the SAE and the British group, and also between the NASC and the British group. (*Picture of conference group is shown on next page.*)

W.E.B. Reports to Ordnance On Dust-Proofing of Vehicles

Detailed design, installation, and maintenance recommendations for the dust-proofing of engines, other moving parts, and electrical equipment of military vehicles were made by the SAE War Engineering Board Dust Committee in its first progress report, compiled for the Tank-Automotive Center, Ordnance Department.

The Committee made a thorough investigation of the present status of the dust problem through a series of five meetings attended by representatives of Ordnance, prime contractors, and suppliers of equipment, assemblies, parts, and accessories.

Members of the Dust Technical Committee are: J. G. Wood, Chevrolet Motor Division, General Motors Corp., chairman; T. M. Ball, Chrysler Corp.; J. M. Davies, Caterpillar Tractor Co.; W. S. James, Studebaker Corp.; L. F. Overholt, International Harvester Co.; E. H. Shepard, Chevrolet Motor Division, General Motors Corp.; and R. L. Weider, White Motor Co.

127 Farm Tire Sizes Approved by Government

One hundred twenty-seven different tire sizes have been approved for farm and industrial tractors and farm implements, the Tractor War Emergency Committee learned from E. F. Brunner, Office of the Rubber Director, at its June 25 meeting in Chicago. Based on recommendations previously made by the TWEC, the farm tire sizes have the approval of both the Office of the Rubber Director and the Farm Equipment and Machinery Division of the War Production Board. Only 126 different tire sizes have been approved for all other types of wheeled equipment, Mr. Brunner said, adding that the entire tire, tube, and rim simplification program is being carried out in cooperation with the Tire and Rim Association.

Eleven specific instructions for users of war-quality farm tires were finally approved at this meeting. Intended to apply to all farm tires made of war-quality materials, reclaim and synthetic, the instructions are:

1. Use these tires with extreme care.
2. They are of war quality materials as stipulated by Government regulations.
3. To ensure the maximum hours of service, watch the tread lugs – if they wear down too fast, immediately add more weight to cut down slippage.
4. Keep tractor tires properly inflated – 28 psi in front and 12 psi in rear tires, except when plowing. Then furrow wheel tire should be inflated to 16 psi. Do not overinflate, as this will result in fast tread wear. Be sure to reduce high shipping pressures.
5. Maintain inflation pressure in implement tires as shown in instruction book.
6. When not in use, the tractor or implement should be stored so that the tires are protected from the light.
7. If not in use for long periods, store tractor or implement so that load is off tires.
8. For certain severe operating conditions, it may be advisable to use steel wheels for the duration.
9. Avoid stumps, stones, deep ruts, and other hazards.
10. Do not load these tires beyond their rated capacity.
11. Maximum speed for highway use should not exceed 20 mph. For farming operations, a maximum speed of 10 mph is recommended.

TWEC recommends that these instructions be placed on each tire, on each unit of rubber-tired farm machinery, and in the various manuals issued by farm machinery manufacturers.

Belief that zinc is no longer as scarce as previously, brought a TWEC recommendation that galvanized rims be made standard again even in those cases where painted rims had been substituted during the acute zinc shortage. Other phases of the tire, tube, and rim problem discussed at this meeting included: standardization of shallow-well and deep-well rims; driver and valve hole standardization; methods to overcome tire mounting difficulties when synthetic tubes, which do not stretch as easily as those made from natural rubber, are used; and tractor rims.

O. R. Schoenrock, chairman of the Alloy Steel Subcommittee, reported that the manual listing SAE steels formerly specified, together with alternate NE or carbon steels now in use or recommended for highly

stressed tractor parts, is approaching completion. (The manual was scheduled for final approval at the July 23 meeting of the TWEC.)

Continued cooperation with the SAE War Engineering Board in subjects of common interest was also indicated. The July 12 meeting of the W.E.B. Iron and Steel Committee was attended by four representatives of the TWEC Alloy Steel Subcommittee – Chairman Schoenrock; W. A. Silliman, Cleveland Tractor Co.; W. H. Naegely, J. I. Case Co.; and J. T. Jarman, Allis-Chalmers Mfg. Co.; and the TWEC meeting on June 25 was attended by W.E.B. Iron and Steel Committee members R. W. Roush, Timken-Detroit Axle Co., and R. B. Schenck, Buick Motor Division, both of whom spoke briefly on the work of the W.E.B. Iron and Steel Committee.

W.E.B. Makes Recommendations For Conservation of Tungsten

Recommendations that will aid materially in reducing the tungsten required for contact points of automotive electrical replacement parts for civilian use are made in a report issued by the SAE War Engineering Board for the Automotive Division of WPB.

These recommendations are:

1. Distributor points of 0.0150 in. diameter and 0.040 in. thickness can be reduced to 0.125 in. diameter and 0.030 in. thickness, while points of 0.187 in. diameter can be reduced to 0.150 in.

Although these reductions will result in more frequent adjustments, this should not prove too serious under wartime driving restrictions, the report states, since a saving of about 40% of the amount of tungsten required for distributor points should be made by these changes.

It is also urged that every purchaser of new points be required to surrender his old ones. It is believed that approximately 60% of these salvaged points can be redressed and used again.

2. Voltage regulators: Most voltage regulator points are not now made from tungsten. Only one manufacturer uses tungsten for the contact points, and the thickness is only 0.020 in.

3. Horn contacts: No new stock of horn contact points has been furnished to horn manufacturers for quite a while. New requirements will come out of present stock.

L. S. Pfost, Massey-Harris Co., is sponsor and J. Fitzsimmons, Delco-Remy Division, General Motors Corp., is chairman of the committee responsible for drawing up this report. The other members are: F. H. Driggs and J. D. Klies, Fansteel Metallurgical Corp.; F. R. Hansel and F. H. Imes, P. R. Mallory & Co., Inc.; J. S. Laird, Ford Motor Co.; and L. R. Vasold, Electric Auto-Lite Co.

Hardness Conversion Table Revised by Cooperative Effort

One standard hardness conversion table for steels to take the place of the various tables that have been used in the past has been approved by the SAE Iron & Steel Division and is ready for submission to the General Standards Committee and the SAE Council for final adoption by the SAE.

The new table was developed in the Subcommittee on Hardness Conversion – ASTM Committee E-1, with the cooperation of the SAE, the American Society of Metals, and representatives from the Government military and naval services. The ASM has already approved the table, and final adoption by the SAE will be consummated as soon as the ASTM and the services have indicated that their approval can be expected.

New Table

It is proposed that this new table supersede the table of Hardness Conversions shown on p. 363 of the 1943 SAE Handbook. Of special interest is the fact that the variations in the present SAE table with the values in the proposed table are very slight, and that in all probability, adoption of the revisions will cause very little confusion among its users.

T. H. Wickenden, International Nickel

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Meet to Coordinate American and British Aero Standards

Flanked by British aircraft engineers and SAE aeronautical standards committee chairmen, SAE President Mac Short, seated, is shown with members of a conference at La Guardia Field, New York, when they met June 4 to plan the coordination of British and American standards.

Standing, left to right, J. D. Redding, SAE staff representative for aeronautics; Flight Lt. D. G. Moffitt, British Air Commission; William Littlewood, chairman, SAE Aircraft Accessories & Equipment Subdivision; H. W. Goodinge, technical secretary, Society of British Aircraft Constructors, London; H. B. Howard, chief, Technical Investigations Branch, British Air Commission; Erle Martin, chairman, SAE Aircraft Engine Propeller Subdivision; Chester E. Mines, chairman, SAE Aircraft Engine Subdivision; W. T. Gemmell, deputy director of standardization, Ministry of Aircraft Production, London; Gustaf Carvelli, chairman of SAE Committees E-6, E-7 and E-10; E. W. Rentz, Jr., SAE staff representative, and John A. C. Warner, secretary and general manager of the Society

About SAE

Receives First "Pioneers of Industry" Award

Edward G. Budd, founder and president of the Edward G. Budd Mfg. Co., Philadelphia, (left) receives from Howard McCutcheon, president of the Student Council of the Murrell Dobbins Vocational School, the first award this Philadelphia school has made. The honor was bestowed in recognition of the fact that Mr. Budd started as a "pioneer machinist who has not lost contact with the worker, though the head of several large war plants." J. Norwood Baker (center) is school principal

CHARLES F. KETTERING was chairman of the National Patent Planning Commission which has recently reported to President Roosevelt, recommending, among other things, that the life of a patent be limited to *20 years from date of application*, instead of *17 years from date of grant* as at present. If this were done, the life of a patent couldn't be extended by keeping the patent pending over long periods of time.

Smaller, better, swifter, more-miles-to-the-gallon automobiles and the air filled with helicopters were predictions made by SAE Past-President **A. T. COLWELL,** vice-president of Thompson Products, Inc., Cleveland, at the wartime conference of the Associated Automotive Engine Rebuilders Association held on June 16.

MERRILL C. HORINE, sales promotion manager, Mack Mfg. Corp., and an engineering consultant to the Tank-Automotive Center, has been appointed technical consultant to **R. L. VANIMAN,** director, Automotive Division, War Production Board, Railroad Retirement Building, Washington. Mr. Horine, a former chairman of the SAE Metropolitan Section, replaces David C. Fenner, who has been recalled to the main office of the Mack Mfg. Corp.

WALTER G. CHANDLER is no longer with the Chrysler Corp. of Canada, Ltd., Windsor, Ont., Canada, where he was an engineer of machine tools specifications. He is now on the engineering staff of Aircraft Hydraulic Supplies, Ltd., also of Windsor, a subsidiary of Bendix Eclipse, and manufacturers of hydraulic apparatus for aircraft.

McCulloch Engineering Corp., Milwaukee, Wis., manufacturers of superchargers, has been acquired through cash purchase of all of the stock by Borg-Warner Corp., Chicago, according to **CHARLES S. DAVIS,** president of Borg-Warner. **ROBERT P. McCULLOCH,** present head and founder of the local concern, will remain as president and director and will have active charge of the plant's operations.

JOHN R. QUINZIO has changed from his position as designer with the Columbus McKinnon Chain Corp., and is now employed by the Sterling Engine Co., Buffalo, in the same capacity.

PAUL G. HOFFMAN, president of Studebaker Corp., has been elected a United Air Lines director.

RICHARD E. DIBNER, CCNY '43, is now an ensign in the Naval Reserve, and is preparing for engineering duties at the Naval Training Station at Princeton, N. J.

EDWARD W. WINEGARD, General American Aerocoach Co., is now headquartered at the Chicago office of the company. He was formerly eastern sales representative for the same company.

Formerly managing engineer of the Canadian Car & Foundry Co., Ltd., Propeller Division, Montreal, Que., Canada, **W. S. HOOVER** is now located in Detroit, in care of Graham-Paige Motors, Inc.

Metal Glass Products Co.'s new general superintendent is **WILLIAM V. DEWEY,** who had been assistant general manager for Thomas & Skinner Steel Products Co., Indianapolis, Ind. Mr. Dewey's headquarters are in Belding, Mich.

NORMAN E. COOK, formerly master mechanic, Monroe Auto Equipment Co., Monroe, Mich., is now doing consulting engineering work, with offices at 7338 Woodward Ave., Detroit.

JOHN D. NEWTON, II, is in the U. S. Army Corps of Engineers, Company E, 361st Engineers Regiment, Camp Claiborne, La. In civilian life Private Newton was junior tool designer, Hudson Motor Car Co., Detroit.

Edward M. Greer (left)

Alexander E. Ulmann (right)

Edward M. Greer is president of Greer Hydraulics, Inc., New York City, which was organized primarily as an aircraft hydraulic engineering company to relieve the critical shortages in aircraft hydraulic equipment. In order to facilitate the large quantity of hydraulic units necessary to the armed forces, Greer Hydraulics has contracted the services of the Dowty Equipment Corp., Long Island City, N. Y., of which Alexander E. Ulmann is head

M. F. FOIST of the Hastings Mfg. Co., Hastings, Mich., has been transferred from District manager at Mt. Lebanon, Pa., to East Pike, Indiana, Pa., where he is working on trouble jobs and special jobber sales.

DON SWITZER, Federal Mogul Service, Division of the Federal Mogul Corp., Detroit, has been made sales manager. Mr. Switzer had been assistant sales manager.

MAJOR JOHN DELANY SUREAU is with the 81st Fighter Groups, stationed at Muroc, Calif.

LT.-COL. CLYDE H. MITCHELL, U. S. Army Air Forces, is executive officer of the Fighter Branch, Wright Field, Dayton, Ohio. Col. Mitchell was formerly resident representative for the U. S. Army Air Forces at Curtiss-Wright Corp., Buffalo, N. Y.

Members . . .

"We have crowded 20 years of development into two in our war engineering," declared SAE President **MAC SHORT** at the Semi-Annual Meeting of the American Society of Mechanical Engineers, held recently in Los Angeles. Mr. Short, who is vice-president of engineering, Vega Aircraft Corp., said that an engineering crisis of last year is a war production project successfully working today – which will become a common practice of tomorrow.

EDGAR T. CONLEY, JR., who has been a major at U. S. Army Headquarters VI Army Corps, Providence, R. I., has been promoted to lieutenant colonel.

Formerly junior test engineer, Wright Aeronautical Corp., Paterson, N. J., **HOWARD F. KIRK, JR.** is now an ensign, USNR, in Squadron 22, NAS, Houma, La., as assistant engineering officer.

HOY STEVENS, formerly superintendent of maintenance, Cleveland, Columbus & Cincinnati Highways, Inc., Cleveland, is now maintenance specialist in the Vehicle Maintenance Section of the Office of Defense Transportation, Washington.

SAE Member Simplifies Automotive Training

Technical Sergeant Karl Orville Botnen, Infantry Motor School instructor, Camp Roberts, Calif., is shown with a device he developed to demonstrate the ignition system of an engine (left), and another device to show soldier-students the operation of a voltage regulator (right). With nearly 24 years of Army Service to his credit, he has received 28 letters of commendation for his ingenious contributions to simplify training, and for inventions turned over to the Government. His "fin fixer," a device to adjust damaged rifle grenade fins, is being manufactured for the Army, and his trouble-shooting guide has been submitted to the War Department for approval and publication

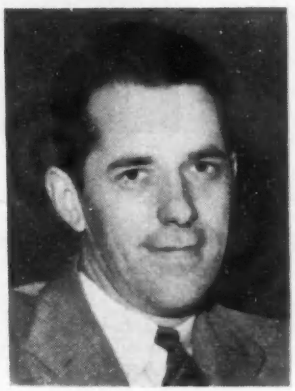
Formerly an instructor in aircraft engines, New York University, School of Aeronautics, New York City, **ARTHUR P. FRAAS** is now test engineer in the Aircraft Engine Division of the Packard Motor Car Co., Detroit.

EARL SWAILES, a veteran of 19 years in the aircraft industry and for the past seven years an inspector with the Bureau of Aeronautics, U. S. Navy, is now chief inspector for the American Aviation Corp., Jamestown, N. Y.

SAE Men Promoted at Hamilton Standard Propellers

Edwin D. Eaton

G. T. Lampton



Thomas B. Rhines

Murray C. Beebe, Jr.

Four SAE members received promotions when Hamilton Standard Propellers Division of United Aircraft Corp. reorganized its engineering staff. They are Edwin D. Eaton, formerly assistant engineer, now administrative engineer; G. T. Lampton, who had been assistant engineer in charge of the experiment engineering section and is now chief experimental engineer; Thomas B. Rhines, promoted from assistant engineer to chief production engineer; Murray C. Beebe, Jr., formerly experimental engineer, now chief development engineer

FRANK D. SANDERSON is a master sergeant in the U. S. Army. He is inspector of motor maintenance at Headquarters Base Ordnance, Advanced Base, San Francisco. He was formerly shop foreman, U. S. Army, Company A, 86th Quartermaster Battalion (LM), Fort Ord, Calif.

RUDOLPH F. GAGG, assistant to the general manager of Wright Aeronautical Corp., Paterson, N. J., has been nominated for vice-presidency of the American Society of Mechanical Engineers. Mr. Gagg was formerly chairman of the SAE Metropolitan Section.

Consolidated Vultee Aircraft Corp.'s president, **HARRY WOODHEAD,** appeared as principal speaker at the first meeting of the recently organized Los Angeles Forum. The Forum aims to bring together representative groups of those engaged in aircraft production or use, as well as affiliated interests.

SAE STUDENT BRANCHES

Allen C. Staley
Chrysler Corp.
and
Chairman,
SAE Student Committee

TO All SAE Members:

I want to introduce to you a group of men – the faculty advisers – whose unselfish assistance to the SAE has made possible the steady growth and development of our Student Branches.

Each year a new group of young men picks up the activities of the Student Branch where others have left off. Behind each Student Branch stands a faculty adviser – giving continuity to the service the SAE is able to render; creating the professional "atmosphere" in which the Branch can thrive and grow.

To faculty advisers goes credit for making SAE ideals and services a living force in the lives of hundreds of automotive engineers-to-be.

You will join me, I know, in expressing to these faculty advisers the sincere appreciation of the Society of Automotive Engineers.

Allen C. Staley

Prof.
William H. Paul
Oregon State
College

PROF. WILLIAM H. PAUL established the Automotive Engineering Course in the school year of 1934-35, and under his supervision the student branch was formed in June, 1935. He has been faculty adviser since that time. He is also staff adviser to the Engineering Student Council.

Prof.
K. W. Stinson
Ohio State
University

PROF. KARL W. STINSON was graduated from Ohio State with a B.M.E. degree in 1916, and received his M.E. professional degree in 1924. He was a lieutenant in the air service during the last war. After the war he worked for Firestone Tire & Rubber Co., and later with the Seagrave Corp. He joined the faculty of Ohio State in 1924, and is now professor of automotive engineering.

Prof. George
C. Autenrieth
College of the
City of New York

PROF. GEORGE C. AUTENRIETH has managed time out from his varied activities to assist in guiding the Branch as one of its faculty advisers. Having been with the college since 1902, Prof. Autenrieth has held every rank on the faculty, from tutor on up. He has also been a consultant engineer with the Edward V. Hartford, Godwood Gas Generator, and Mitton Management Companies.

Prof.
Wilford L. Stork
College of the
City of New York

PROF. WILFORD L. STORK was very active in the machine and tool design field before joining the College of the City of New York in 1927. It is through this experience that he is able to participate in, as well as plan, the lecture program of the Branch. A faculty adviser of the Branch since its inception early this year, Prof. Stork has contributed much to its success.

Philip Blenkush
University of
Detroit

PHILIP BLENKUSH, who completed the primary and secondary phase of the Civilian Pilot Training program and was part-time instructor for the primary phase of the CPT program at the Detroit Institute of Technology, is an instructor in the University of Detroit's Department of Aeronautics.

G. LESTER JONES, who had been works manager, War Products Division, Eversharp, Inc., Chicago, has left this position to join the Sperry Gyroscope Co., Inc., of Nassau County, L. I., N. Y., as air pilot engineer.

Formerly experimental test engineer of Pratt & Whitney Aircraft, Division of United Aircraft Corp., East Hartford, Conn., **ROLAND S. ELY** is now field engineer of Sterling Aircraft Products, New York City.

ENSIGN WILLIAM G. BURT, JR., USNR, is assistant radio superintendent at the Brooklyn (N. Y.) Navy Yard. Ensign Burt had been at the Naval Training Station (Radar), at Massachusetts Institute of Technology, Cambridge, Mass.

MICHAEL E. RIPLEY is now assistant motor officer, Headquarters and Service, 371st Engineer General Service Regiment, Camp Ellis, Ill. He is assigned to the operation and maintenance of trucks, tractors, graders and other equipment used in general construction by the Corps of Engineers.

G. H. FREYERMUTH, Standard Oil Co. (N. J.), New York City, has been transferred from assistant manager, Engineering Division, Sales Department, to technologist.

CARL H. DEFFENBAUGH, who had been equipment engineer, U. S. Department of Agriculture, Forest Service, Portland, Ore., is principal automotive adviser in the Ordnance Service Command Shop, War Department, Vancouver Barracks, Wash.

Formerly with the Bureau of Aeronautics, Office of General Inspector of Naval Aircraft, Western District, Los Angeles, **CAPT. B. G. LEIGHTON,** USNR, is now at the Army Air Forces Procurement District Office, in the same city.

ROBERT W. RUMMEL has joined Transcontinental & Western Air, Inc., Kansas

FACULTY ADVISERS • • •

Prof. Joseph Liston
Purdue University

PROF. JOSEPH LISTON joined Purdue in 1937 as assistant professor of aeronautical engineering, after serving in the same capacity at the University of Oklahoma. Since 1942 he has been an associate professor in aeronautical engineering. He is the author of a book, "Aircraft Engine Design," published in 1942, and was SAE 1942-43 chairman of the Indiana Section.

R. G. Hilligoss
Oklahoma
A & M College

R. G. HILLIGOSS was graduated with a bachelor of science degree from Kansas State College in 1937. From 1937 to 1939 Mr. Hilligoss was employed as assistant automotive inspector by the Skelly Oil Co. Since that time he has been assistant professor in the School of Technical Training, Oklahoma A & M College, teaching internal combustion engine mechanics.

Prof.
E. H. Hamilton
New York University

E. H. HAMILTON, associate professor of automotive engineering holds patents on a number of mechanical devices such as thermometer wells, steam calorimeters, and total pressure gages. The professor is author of several books, and also many articles on internal combustion engines.

H. W. Barlow
Texas
A & M College

DR. HOWARD W. BARLOW, professor and head of the Aeronautical Engineering Department of A & M College of Texas since 1940, entered the aircraft industry in 1924 via the Glenn L. Martin Co. He was graduated from Purdue University in 1927 and until 1929 was staff engineer for the Martin Co. He received the degree of doctor of engineering science in 1940.

Prof.
W. I. Truettner
Texas
A & M College

W. I. TRUETTNER, whose work has been mainly devoted to fields of thermodynamics, internal combustion engines and automotive engineering, has been associate professor of mechanical engineering at the A & M College of Texas since 1930. He received his B.S. degree in mechanical engineering in 1928 and an M.S.E. degree in aeronautics in 1930 from the University of Michigan.

Elwood K. Harris
General Motors Institute

ELWOOD K. HARRIS, native of Canada, was employed as instructor in engineering drawing at General Motors Institute in 1929, and later became instructor for automobile body drafting. His present position is that of chairman of the Drawing and Design Department.

Prof.
Dean A. Fales
Massachusetts Institute of Technology

DEAN A. FALES, associate professor of automotive engineering at M.I.T., became a member of the staff following his graduation from that college. During World War I he was head of the airplane and seaplane motors department of the Army and Navy Ground Schools. He returned to M.I.T. to conduct engine courses for the Army Ordnance School, continuing also as a member of the student instructing staff. He is a former chairman of the New England Section of SAE and a former Councilor.

Einar T. Hansen
University of Wisconsin

EINAR T. HANSEN has been instructor in heat-power engineering at University of Wisconsin since 1928. An instructor of thermodynamics, heat-power engineering, refrigeration, air conditioning, and diesel engines, he has also done consulting and testing work on steam boilers, steam engines, and outboard motors.

Henry R. Kroeger
University of Oklahoma

H. R. KROEGER has been assistant professor of mechanical engineering at Oklahoma University since September, 1941. His varied experience includes teaching at both Ohio and Minnesota as well as positions with a number of engineering concerns.

City, Mo., as senior engineer of new equipment. Mr. Rummel was formerly chief engineer and a member of the board of directors of Rearwin Aircraft & Engines, Inc., Kansas City, Kans.

For his extensive technical paper published in the August, 1942, ASTM Bulletin, **WALTER BONSACK,** chief metallurgist and director of research laboratories, The National Smelting Co., Cleveland, was recently awarded the 1943 Dudley Medal of the American Society for Testing Materials. This award commemorates the name of the Society's first president, and is made in recognition of technical papers of outstanding merit and constituting an original research contribution.

N. W. HOLBROOK, who had been group leader of tool planning, Consolidated Vultee Aircraft Corp., Nashville, Tenn., is now with the Lombard Iron Works Co., Augusta, Ga., as chief tool engineer.

WILLIAM J. CHALKLEY has been promoted from lieutenant to captain. Capt. Chalkley can be reached in care of Headquarters First Armored Corps, A.P.O. 758, Postmaster, New York City.

Formerly administrative engineer for the Brewster Aeronautical Corp., Hatboro, Pa., **GEORGE D. EVANS** is now with the Columbia Aircraft Corp., Valley Stream, L. I., N. Y., as chief engineer.

MILES H. ANDERSON, who had been instructor in auto mechanics, Napa (Calif.) Junior College, is now employed by the California State Department of Education, Vocational Education for War Production Workers, as a special state supervisor of war production training. He is assigned to work in cooperation with the Training Within Industry group of the War Manpower Com-

mission. Mr. Anderson is charged with supervision of the administration of foremanship training in war industries.

Formerly factory manager for the International-Plainfield Motor Co. of Plainfield, N. J., **ANSEL N. MORTON** is now with the Mack Mfg. Corp., New York City, as general production manager.

MATTHEW URY is a captain in the U. S. Army Ordnance Department. He is stationed at the Holabird Ordnance Depot, Baltimore.

THOMAS E. ROUNDS, JR., who had been assistant chief engineer, Norma-Hoffmann Bearings Corp., Stamford, Conn., has joined the Barden Corp. of Danbury, Conn., as product engineer.

T. A. BOYD, head of the Fuel Department, Research Laboratories Division, General Motors Corp., Detroit, has been nominated for a two-year term on the American Society for Testing Materials Executive Committee.

Dr. R. P. Dinsmore

DR. R. P. DINSMORE, pioneer in rubber research and development manager of the Goodyear Tire & Rubber Co. since 1939, was elected vice-president in charge of research and development at a recent meeting of the Board of Directors.

Formerly in the New York City office of Associated Transport, Inc., **JAMES G. HAYDEN** has been transferred to Charlotte, N. C. Mr. Hayden is director of conservation of the Southern Division of the company.

Formerly in the Ordnance Tank Engineering Office, Detroit, **LT. PAUL L. HAINES** is now at the Tank-Automotive Center, also in Detroit, where he is working on tank winterization.

EUGENE D. BEDAL is now with the Douglas Aircraft Co., Inc., Daggett, Calif., as liaison engineer. Mr. Bedal was formerly layout draftsman for the same company at the El Segundo, Calif., plant.

W. W. SCHEUMANN has transferred from the Cities Service Oil Co., Bartlesville, Okla., to Cities Service Refining Corp., New York City. Mr. Scheumann had been general superintendent of the Refining Division at Bartlesville.

Francis P. Healy

At a recent luncheon, the anniversary of **FRANCIS P. HEALY'S** 20th year with the Van Norman Machine Tool Co. was observed. During Mr. Healy's 20 years with Van Norman he has made many achievements in the design and engineering of automotive service machines, including the new No. 222 con-rod boring and grinding machine just announced by the company.

WALTER S. KUT is a lieutenant (jg) with the Bureau of Aeronautics, Navy Department, and is under instruction at the California Institute of Technology. Lt. Kut was formerly associate mechanical engineer, U. S. Army Signal Corps Radar Laboratory, Camp Evans, Belmar, N. J.

RUSSELL W. GAMAGE is now a research engineer for United Aircraft Corp. Mr. Gamage, who received a Master of Science degree from the University of Connecticut in June, had been salvage engineer for Pratt & Whitney Aircraft, Division of United Aircraft Corp.

A. F. LEGGETT has joined the Ford Motor Co., Dearborn, Mich., as training and personnel supervisor of the Aircraft-Engine Service Department. Mr. Leggett was formerly zone service and mechanical manager of the Chevrolet Motor Division, General Motors Sales Corp., Detroit.

Training men and women for essential wartime jobs today ranks as one of the major contributions of the University of California at Los Angeles to the state's hundreds of industries. Many thousands of trainees come from so-called non-essential industries and offices to train for specific jobs in vitally important war production plants. Among the supervisors of this tremendous program is **THOMAS A. WATSON,** associate in mechanic arts at U.C.L.A.

PAUL C. ROCHE, field engineer, Lord Mfg. Co., Erie, Pa., gave a talk on "Protective Engineering for Military Installations of Delicate Equipment," at the Los Angeles convention of the ASME on June 17. The subject matter pertained to the protection of aircraft instruments and delicate apparatus in the presence of vibration and shock.

H. J. STAGG, sales metallurgical engineer for the Crucible Steel Co. of America, spoke on "Tool Steels" before a joint meeting of the American Society of Tool Engineers and the American Society for Metals, held recently.

F. R. GAYLORD has left the Columbia Transfer Co., Kansas City, Mo., where he was maintenance engineer, to join Columbia Terminals Co., Indianapolis, Ind.

MAJOR LESTER D. GARDNER, previously executive vice-president of the Institute of the Aeronautical Sciences, is now chairman of the Council of the organization.

CAPT. ALEC A. SMITH heads a small South African unit of salvage experts which has been doing valuable work in the desert salvaging and finding spare parts from J. U. 52's left behind by the Luftwaffe. Capt. Smith was formerly assistant chief inspector, South African Airways.

In a post-war program calling for the employment of 58,000,000 people and a national income of at least 140 billion dollars, sales management will be held responsible for the sale and distribution of sufficient goods to make this goal possible, declared **J. N. BAUMAN,** vice-president in charge of sales, The White Motor Co., in addressing the Sales Executives' Club of New York recently on the subject, "The Sales Executive's Role in Post-War Planning." He suggested that sales managers, faced with this tremendous task, should take the initiative in seeing that sound post-war plans are laid now in a coordinated and systematic manner.

J. N. Bauman

HARRY A. HUEBOTTER is at the U. S. Army Basic Training Center, Fresno, Calif. He had been district experimental engineering officer, U. S. Army Air Forces, Materiel Center, Detroit.

J. J. MURRAY, president of the Aircraft Holding Corp., Culver City, Calif., has accepted for the duration the post of head motion picture studio technician with the Army Signal Corps Photographic Center, Western Branch, Beverly Hills, Calif.

OLIVER W. INSKEEP is engaged in consulting engineering work in Detroit. He had been in charge of engine design at the General Motors Research Laboratories, Detroit.

Formerly diesel engineer for the Mack Mfg. Corp., Allentown, Pa., **R. A. JEHEBER** has been advanced to the position of assistant to the chief engineer, and is now in the New York City office of the company.

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Muskegon SAE Group Has First Birthday

Rounding out its first year with record attendance at the June 25 meeting, 92 members and guests of the Muskegon SAE Club heard Lt. Col. Carl E. Cummings of the Army Ordnance Department, speak on current tank design. Pictured above, from the left: Robert Insley, vice-president, Continental Motors Corp., Stuart Nixon, retiring chairman, and Col. Cummings

News of the Society

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Group Formed to Study Shot, Surface Peening

The newly formed Subdivision on Shot Peening of the Production Division of the SAE Standards Committee set up an extensive program at its first meeting, held June 8 in Detroit.

The Subdivision, composed of both users and producers of shot and surface peening equipment, made plans to:

1. Develop size standards for shot to be used in peening to increase the fatigue strength of materials and for shot for cleaning purposes.

2. Develop a standard procedure for testing shot for fracture and wear.

3. Make recommendations concerning the manufacture of shot, including material specifications, manufacturing processes and equipment.

J. O. Almen, Research Laboratories Division, General Motors Corp., is chairman of the group. Other members are: L. L. Andrus, American Foundry Equipment Co.; C. A. Boltman, Panghorn Corp.; M. Z. Delp, Studebaker Corp.; Paul McConnell, Globe Steel Abrasive Co.; A. V. Mathey, Wright Aeronautical Corp.; R. L. Mattson, General Motors Corp.; E. A. Milke, Harrison Abrasive Corp.; H. J. Noble, Jacobs Aircraft Engine Co.; S. S. Parsons, Parsons Engineering Corp., A. E. Proctor, Ford Motor Co.; W. L. R. Steele, Eaton Mfg. Co.; R. E. Van Deventer, Packard Motor Car Co.; F. P. Zimmerli, Barnes-Gibson-Raymond Division, Associated Spring Corp.; and H. H. ZurBurg, Chrysler Corp.

SAE-W.E.B. Rubber Group Reports on Substitutes

Specific recommendations are made for the substitution of synthetic rubber and other less critical materials for the crude rubber previously used in many vehicle parts in two reports recently released by the SAE War Engineering Board.

The report "Substitution of Synthetic Rubbers for Crude Rubber in Automotive Service Parts," makes recommendations concerning the rubber articles mentioned in Group 29-2A of Rubber Order M-15-B. It was compiled for the Office of Rubber Director of WPB, by the Rubber Committee of W.E.B.

Parts used on the M-10 Tank Destroyer are covered in the sixth progress report on "Reduction of Rubber in Combat Vehicles," which has been issued for the Ordnance Department by the Tank Subcommittee of the Rubber Committee.

New SAE Postal Key Numbers

Use of the new postal key numbers by SAE members and others writing to the Society's various offices, indicated below, will help to insure prompt delivery of mail:

Society of Automotive Engineers, Inc.,
29 West 39th Street,
New York 18, N. Y.

SAE West Coast Branch Office,
530 West Sixth Street,
Los Angeles 14, Calif.

SAE War Activities Office,
912 New Center Bldg.,
Detroit 2, Mich.

A. J. Underwood,
3-210 General Motors Bldg.,
Detroit 2, Mich.

Detroit Section SAE,
100 Farnsworth,
Detroit 2, Mich.

Hardness Conversion Table Revised by Cooperative Effort

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Co., chairman of the SAE Iron & Steel Subdivision on Hardness Conversion Charts, was the SAE representative on the ASTM subcommittee, of which Reid L. Kenyon, American Rolling Mill Co., is chairman.

OBITUARIES

A. E. Bronson

A. E. Bronson, SAE member since 1923, and vice-president and secretary of the Dill Mfg. Co., Cleveland, died May 26. Mr. Bronson joined the Dill company in 1911. Throughout his early service with the company he was primarily responsible for the development of sales and became well known throughout the tire and automotive industries. In later years he concerned himself with the development of new products, many of which have contributed to the present war effort.

Earle D. Parker

Earle D. Parker, vice-president of the Barber-Colman Co., Rockford, Ill., died suddenly on June 12. Mr. Parker had been an SAE member since 1916. He joined the Barber-Colman company as designer and later became chief draftsman. He was 63 years old.

Herman A. Zeller

Herman A. Zeller, who was with General Motors India, Ltd., died recently. Mr. Zeller was 52 years old.

Oregon Section Student Awards

The Oregon Section made its annual prize awards to the students presenting the three outstanding engineering papers for the year 1943. These awards – $25 war bonds – were made to Archie F. Fanger for a paper and demonstration of his construction of a "Small Eddy Current Dynamometer"; Edward B. Shields, Jr., and Herbert L. Tollisen, Jr., for a paper on "What Harm Detonation?"; and J. R. Ullman for "Tetraethyl Lead in Motor Gasolines." These men are all from Oregon State College

Archie F. Fanger

Edward B. Shields, Jr.

Herbert L. Tollisen, Jr.

J. R. Ullman

SECTION ROUND-UP

Detroit . . . Coming to bat May 17 on the subject of post-war cars, Frank Jardine, Aluminum Co. of America presented his ideas for the "194X models." Julian Frey, Ethyl Corp., gave a paper on possibilities of fuels of various antiknock values; T. H. Risk, also of Ethyl, was co-author.

Kansas City . . . "The Manufacture of Metal Tubing with the Present and Future Application to Industry was J. P. Dods' subject, June 21. Mr. Dods is director of research, Summerill Tubing Co., Bridgeport. Cocktails and dinner preceded.

Metropolitan . . . Combat moving picture session – made possible by Army and Navy pictures of land, air and sea battles – highlighted the smoker held July 22.

Mid-Continent . . . Carl Tangner, new Section chairman, called a meeting for June 22 to form plans and subcommittees for next season.

New England . . . Annual meeting held in Greenfield, June 29, in honor of Treasurer Albert Lodge. Considerable attention was given to serious Section affairs, but the group took time to ride with Dobbin and the one-horse shay to the Country Club, where golf and the 19th hole were enjoyed . . . Discussions were held on present-day values of heavy-duty trucking equipment, diesel engines, lawn mowers, boats, and proper handling of service on the home and battle-fronts.

Oregon . . . Speaker of the evening, June 11, was George L. Neely, manager of the Lubrication Department of the Standard Oil Co. of Calif., who spoke on fundamentals of lubrication . . . Section Chairman Z. C. R. Hansen announced Vice-Chairman J. P. Bourne was transferring to a position outside Oregon Section territory. Corsages were presented to all the women at the recent Ladies' Day Luncheon. Decorations were red, white and blue, and the lady holding the lucky number was presented with the large centerpiece of red, white and blue flowers which adorned the speakers' table.

Southern California . . . Last meeting of the season, on June 11, drew more than 250, with 150 for dinner. Speakers were: N. D. Lombard, Douglas Aircraft Co., Inc.; Wallace E. Brainard, Consolidated-Vultee Aircraft Corp.; F. C. Hoffman, Lockheed Aircraft Co. . . . On the preceding Saturday Governing Board members and wives gave a surprise party for outgoing Chairman Foster Gruber and Mrs. Gruber. New chairman is Wallace Linville, General Petroleum Corp. of Calif.

Colorado Group . . . June 1 meeting held at Hendrie & Bolthoff Mfg. & Supply Co. Lew Williams talked on "Aviation Motors," and two movies, "Ignition" and "The Story of the Spark Plug," were shown.

Twin-City . . . Heard Maior A. V. Stallard speak on "Packing and Loading of Export War Materials." Group recently received Council recognition.

SAE West Coast Transportation and Maintenance Meeting

Palace Hotel
San Francisco
August 19-20

THURSDAY, AUG. 19

MORNING

Wallace Linville, Chairman

War Tires – Availability and Performance Characteristics
– P. W. Drew, Goodyear Tire & Rubber Co.

Preventive Maintenance and Inspection Procedure
– E. N. Hatch, American Brakeblok Division, American Brake Shoe & Foundry Co.

AFTERNOON

K. A. Ayers, Chairman

Transportation Forum – SAE-ODT
– Roy H. Long, Office of Defense Transportation; E. W. Templin, Los Angeles Bureau of Power & Light; Sidney B. Shaw, Pacific Gas & Electric Co.

■

SMOKER

Fraternity Club 7:30 p.m.

S. G. Culver, Chairman

Paper and Movie on Alcan Highway

FRIDAY, AUG. 20

MORNING

Z. C. R. Hansen, Chairman

Bus Operation under War Conditions
– T. C. Howe, North Coast Transportation Co.

Freight Handling and Distribution
– J. L. S. Snead, Sr., Consolidated Freightways, Inc.

Projected Developments in Fuels and Lubricants
—Frank W. Kavanagh, Standard Oil Co. of California

AFTERNOON

Dr. A. G. Cattaneo, Chairman

Air Cargo Planes – Engineering Viewpoint
–J. B. Kendrick, Vega Aircraft Corp.

Air Cargo Planes – Operator's Viewpoint
– Thomas Wolfe, Western Air Lines

■

DINNER

California Room 7 p.m.

A. G. Marshall, Chairman

"Fleet Engineering Problems" – Round-Table Discussion

Sponsored by Four SAE West Coast Sections

★

Most Metals Are Critical Despite Achievements in Conservation

MORE vigorous than ever before, the Army, Navy, and WPB programs for the conservation of critical materials are accelerating on a wide range of industrial fronts.

Three years ago in this land of plenty, the idea of conservation of anything was branded "crackpot" or at least "unnecessary" by most design engineers.

After decades of metal alloying experience, with better physical characteristics being achieved by high alloys each year, the idea of substitution gave pause to our officials who were charged with improving weapons.

However, early studies by the National Defense Advisory Committee, under the leadership of SAE Member E. R. Stettinius, and the elaborate reports of the National Research Council, stimulated a small group of metallurgists to do battle.

Top Army and Navy officers had to be sold on the idea, repugnant as it was to those who always wanted the best.

Despite the fact that millions of pounds of critical materials have been conserved through the coordinated activities of the Army, Navy, and WPB with the SAE, other engineering societies, and numerous Government agencies, the nation is not out of the woods in respect to sufficiency of materials to arm the United Nations' armies and fleets.

Review:

Non-Ferrous

- Tin stocks, plus new smelting capacities and ore deposits, plus detinning operations, add up to *less* than the current rate of consumption. Less critical materials must be used for coating, more tin plate must be electroplated (a saving of about two-thirds) and less tin must be used for solders and bearing materials.
- Aluminum is so critical that the balance between essential demand and supplies may not be achieved this year. Wrought alloys are very critical. Casting alloys appear to be available for military requirements. Secondary grades (over 1% fe or zn) should be used when practicable.
- Copper, high grades (less than 1% pb in base alloys), cannot meet the essential demand. Lower grades of brasses and bronzes should be used.
- Cadmium demand exceeds by far the supply. (See "Drawings Blamed for 'Cad' Shortage," page 51).
- Zinc has passed through "extremely critical," "less critical," and back to "very critical" during the past three years. The Army and Navy's steel cartridge shell program saved the day for zinc and copper, but other uses have put great pressure on the available supplies of the metal.
- Bismuth remains critical, but if some unforeseen demand arises, the situation will be desperate.
- Magnesium is still critical, despite the rapid increase of new facilities.
- Lead is less critical, and conservation experts recommend the use of lead, alloyed with not more than 2½% of tin for electro-

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Battle of Corrosion Won

Development and Standardization of Approved Methods for the Preservation of Engines and Spare Parts Help Win the War

By A. AYERS, Chairman, SAE Subcommittee E-9,
Preservation of Engines, Spare Parts, and Engine Accessories

THE D- - sy Belle has been grounded.

A vital engine part, weakened by corrosion, has prematurely failed. However, on the next scheduled mission of the squadron the D- - sy Belle is in the air at its customary place in the formation. A service crew has been able to install a new engine in record time. This engine, removed from its moisture-resistant bag was clean, dry and ready for running. Furthermore, the new method by which it was treated for storage has minimized corrosion failure to a degree where it can now be said: "The Battle of Corrosion is Won."

This improved storage method can be applied to all aircraft engines by the use of a new series of SAE Aeronautical Standards and Specifications.

At United Nations' airdromes throughout the world, time-consuming cleaning treatments have been eliminated by the use of the materials and methods represented by these new specifications and standards. With the present rate of production and shipment overseas, millions of dollars worth of aircraft equipment can be placed in effective operation with the minimum of lost time.

The standardization program on aircraft engine preservation, started nearly three years ago by Subcommittee E-9, has resulted in the publication of 15 standards and specifications, six of which have been revised upon the basis of new information, and re-published. Twenty-four new projects are now on the agenda of this committee.

Works with Army, Navy

The entire work of this committee has been closely coordinated with the Army Air Forces and Navy Department. The ideas of the working group are reflected not only in SAE standards, but also in the Army-Navy specifications which are now used by the entire aircraft engine industry in preserving and packaging engines and parts for storage and shipment.

Cooling and condensation of high hu-

Members of Committee E-9 follow:

A. P. AYERS, chairman, Pratt & Whitney Aircraft; H. L. HEATH, Allison Division, GMC; H. A. LOCKWOOD, Chandler-Evans Corp.; B. L. SHARON, Lycoming Division, Aviation Corp.; R. D. GOODALL, Davison Chemical Corp.; and M. H. YOUNG, Wright Aeronautical Corp.

Standards completed by E-9 are:

AS-6 Envelope, Transparent, Moisture-Resistant;
AS-7A Plug, Dehydrator-Cylinder;
AS-8 Plug, Dehydrator-Crankcase;
AS-9A Protector and Cable Attachment, Spark Plug Terminal;
AS-10 Humidity Indicator;
AS-11 Equipment, Spray, Corrosion-Preventive Compound;
AMS-2570 Engine, Aircraft, Procedure for Preparation for Storage of:
AMS-2574 Preservation of Engines (Limited);
AMS-3070A Oil, Corrosion Preventive, Carburetor Slushing;
AMS-3072A Compound, Corrosion Preventive (Aircraft Engine);
AMS-3075 Compound, Corrosion Preventive (Parts and Equipment);
AMS-3160 Solvent, Petroleum;
AMS-3420 Agent, Dehydrator, Silica Gel;
AMS-3540 Wrapper, Grease-Proof Paper, Single Ply;
AMS-3610 Plastics, Film-Transparent.

midity during tropical nights has damaged untold quantities of aircraft engines. Valuable manpower has been consumed at the many tropical airfields of the United Nations' far-flung battle line to recondition engines that had suffered from the lack of adequate protection against corrosion.

Began in February, 1940

The need for improved materials and methods for preserving aircraft engines having been established, Subcommittee E-9 went into action in February, 1941. A survey of engine protective practices of the Army, Navy, airlines and engine manufacturers revealed that considerable work had been done and that some interesting tests were under way.

Early, it was established that:

- Light oil, properly inhibited, was a better protection against corrosion of assembled engine parts than the heavy oils used for this purpose, and
- The entire interior surfaces of the engine had to be coated with this oil instead of coating cylinder bores only. Furthermore,
- Dehydrating agent proved to be additional assurance against corrosion when used in conjunction with a moisture-resistant enclosure.

One test conducted by a committee member proved the worth of these precepts. Two new identical engines were taken from an assembly line and prepared for shipment. One was treated with heated heavy oil compound and the other preserved with the inhibited light oil (a basis for AMS 3072) and packed with dehydrating agent (AMS 3420) as provided by the procedure (AMS 2570). Both were shipped in the hold of the same ship from the Eastern seaboard to the Panama Canal Zone. Here they were landed and stored outdoors in salt atmosphere for three months before the first inspection. The engine packed the old way showed evidence of corrosion. It was shipped back to its factory in the United States where it was disassembled. Red rust was found on many of the innermost working parts.

SAE Method Proved

The other engine was inspected for evidence of corrosion at scheduled periods, being repacked each time without re-oiling. Finally, after the engine had passed through seasonal changes, when the worst corrosion conditions were known to exist, it also was returned to its factory, completely disassembled and inspected. It was found to be in such excellent condition that it was reassembled, tested and sold as a new engine. The new SAE procedure proved to be adequate for preserving aircraft engines under tropical conditions.

The activities of this committee now have been expanded to include the preservation of spare parts and equipment. This new program includes specifications for anti-corrosive papers, preservative greases, carton materials, sealing tapes, and moisture-resistant carton liners for packaging spare parts.

As in all SAE standards projects, the committee first made a survey of:

- Existing practices of manufacturers,
- Practices of our own and foreign military services,
- Research and development work of the Army, Navy, and industry.

This material was augmented with special research tasks assigned to committee members as need for special data developed.

Urges Subcontracting To Save 'American Way'

"We must win without destroying the very America we are fighting to preserve," Brig.-Gen. Robert W. Johnson told the *SAE Journal* in explaining the redoubled efforts of the Smaller War Plants Corporation to spread subcontracting. He is SWPC's chairman.

"American small businesses must not be permitted to fail because of wartime dislocations if the America we know is to survive."

He pointed out that it was significant that many great industries, like that of manufacturing automobiles, trucks, buses, aircraft and other automotive equipment, were begun by small business men who took a chance and gambled on their ideas in an economy of free enterprise.

Failure of the small businessman, he said, would inhibit development of all industry and he called upon prime contractors to subcontract as much business as possible.

Patent Laws Face Changes by Congress

Chairman Frank W. Boykin, chairman of the House Committee on Patents, told the *SAE Journal* that he plans at once to draft legislation to put recommendations made by the National Patent Planning Commission into law.

The Commission, headed by SAE Member Charles F. Kettering, established by the President's Executive Order of Dec. 12, 1941, recommended:

- Compulsory recordings of contracts concerning patents;
- Creation of a single court of patent appeals;
- Licensing patents relating to the national defense;
- Declaration of Congressional policy with respect to the test or standard for determining patentability and invention;
- Empowering the Patent Office to report on the validity of patents involved in suits for infringement, and
- Limiting the life of a patent to 20 years from date of application, instead of 17 years from date of grant – as at present.

The War...And You!

Friend—don't think this war doesn't affect you. It does. It's pushing the world twenty years ahead of time; stimulating the development of devices you may now be making or using. After the war, the average American's life is destined to be fuller, more exciting, more comfortable due to these new products. And just as Weatherhead has helped build the nation's automobiles, airplanes and refrigerators in the past, peace will find us prepared to join you in building these established products as well as the many new ones certain to come out of the war.

Look Ahead with

Weatherhead

THE WEATHERHEAD COMPANY, CLEVELAND, OHIO
Manufacturers of vital parts for the automotive, aviation, refrigeration and other key industries.

Plants: Cleveland, Columbia City, Ind., Los Angeles
Canada—St. Thomas, Ontario

Drawings Blamed For 'Cad' Shortage

When military requirements for cadmium recently showed up about three times the estimated available supply, conservationists went into action to find out why.

Some high grade sleuthing disclosed that aircraft drawings – thousands of them – were carrying the note CADMIUM PLATE, despite conservation orders, memorandums, and directives conserving the metal by use only when essential.

Further investigation disclosed that youthful draftsmen and draftswomen who usually begin their engineering work practicing drawing bolts, nuts, and other small parts, had included this historic note as a matter of routine. Lack of sufficient drafting-room supervision resulted in a wild stampede toward the nation's dwindling supplies. The metal occurs chiefly in certain zinc ores.

Hurried telegrams, phone calls, and visits took place at once to get the demand down to a reasonable supply. About two-thirds of the U. S. use of 3000 tons in 1940 was for cadmium plating, and this to prevent corrosion of small parts.

Hits WPB's Myopia

McCarran Cites Truman Committee Truck Findings

Reporting on conclusions of the tentative report of an investigation of wartime motor vehicle operations, being made at his request by the Senate Truman Committee, Senator Pat McCarran summarized these findings:

- Parts problems have been accentuated because Government agencies, particularly WPB, failed to foresee increased traffic demands of buses and trucks and hence failed to provide for sufficient steel for replacement parts;
- Manufacturers of vehicles and parts should be permitted to restore pre-Pearl Harbor inventories and to maintain them;
- "Most cordial and intimate cooperation" would be required to prevent waste and interferences in solving these problems by existing Government agencies in the highway transport field today. Inter-agency cooperation to date has been "too little and too late."

Commenting on the forthcoming Truman Committee report, Senator McCarran said:

"If any phase of the problem has been slighted by the Truman Committee's report it is the need that manufacturers be left free to build normal, efficient models instead of the vastly inferior models programmed by WPB.

Mr. McCarran indicated that the report will call for a study looking toward one strong director of all truck problems.

APPLICATIONS Received

The applications for membership received between June 10, 1943, and July 10, 1943, are listed below. The members of the Society are urged to send any pertinent information with regard to those listed which the Council should have for consideration prior to their election. It is requested that such communications from members be sent promptly.

Baltimore Section: William E. Barnett, Howard R. Niggles.

Buffalo Section: Stuart H. Hahn, Victor Newton, Marvin J. Parks, John M. Readey.

Canadian Section: Donald Caleb Gibbard, Russell Lang Gibson, Joseph O. Goodman, C. J. Gravelle, F. Arthur Kuhn.

Colorado Club: Oscar Robert Haueter, Stanley R. Shatto.

Chicago Section: Apex Machine Co., Robert Theodore DeNormandie, Harry S. Golden, James W. Leeming, Arend R. Tanis.

Cleveland Section: Charles W. Baker, John H. Collins, Jr., Samuel J. Kaufman, Thomas F. Shaffer.

Detroit Section: James H. Barnes, Donald R. Bradley, Noble Clark, S. A. Flickinger, Martin Hebert, Jr., Edward H. Hopson, Frederick L. Hunter, Kenneth H. Jacobs, George A. Johnson, Vincent Thomas Kepler, Bob G. Lift, William H. Mann, Jr., Royce G. Martin, Earl L. Ramsey, Harry C. Riggs, Walter G. Robbins, Capt. Irvin Trowbridge, Jr.

Indiana Section: Earl D. Porter, Sr., James Richard Reed.

Kansas City Section: William Erwin Briece, Arthur E. Smith.

Metropolitan Section: Harold Barkan, Edward Alan Cohn, John W. Collins, Jr., John M. Craig, Elbert Fowler, Russell A. Hedden, Otis Eugene Hunt, Bernard F. Klein, Lawrence D. Landrine, Jr., Hans Erich Lasker, Capt. William Thomas Tierney, Harry Milford Willis.

Mid-Continent Section: John C. Day, Floyd E. Selim.

Milwaukee Section: Audrien J. Bloomberg, Joseph E. Bloomberg, Wesley Evans Klatt.

New England Section: James F. Wanless.

Northern California Section: Lt. John Peter Allemand, Donald R. Lockwood, George W. Quinn, Jr., Earl Ramsey Rankin.

Northwest Section: Edward A. Huletz.

Oregon Section: Robert V. Turner.

Philadelphia Section: Charles Edward Burgess, Louis E. Ehring, Carl A. Wahlquist.

Pittsburgh Section: Milo M. Dean, Charles W. Woods.

Southern California Section: John T. Abbott, Dean B. Baumunk, John P. Davies, William D. Hemenway, Henry Ewin Jordan, Arthur H. Kannady, Thomas F. Morrissey, Charles W. Perelle, Martin J. Poggi, Albert Anthony Struckus, I. J. Wilson, Arthur Corthell Wrotnowski.

Southern New England Section: Warren E. Darrow, Jr., Runo S. Johnson, Edward H. Markham, Henry O. Wuelfing.

Southern Ohio Section: Howard H. Olsen, Philip C. Stolp.

Syracuse Section: James M. Fiske, Louis L. Otto.

Texas Section: Av/C Leonard Carl Halverson.

Twin City Group: John Calvin Miller.

Washington Section: Eduardo de Mello Alvarenga, Capt. Hugh M. Cole, Lt.-Col. John H. Frye, James Cheng-moa You.

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Specify

MECHANICS
Roller Bearing
Universal Joints

In MECHANICS Roller Bearing UNIVERSAL JOINTS integral keys transmit the torque. These keys (not bolts nor screws) do the driving. Rugged, dependable and economical, MECHANICS Roller Bearing UNIVERSAL JOINTS long have been used in leading cars, trucks, busses and tractors as original equipment. For the duration, they are going into fighting front machines and essential home front equipment. In the meantime, our engineers are at your service to help design and specify power transmission applications that will give your post-war models several war-developed advantages.

MECHANICS UNIVERSAL JOINT DIVISION
Borg-Warner. Corp. 2020 HARRISON AVE., ROCKFORD, ILL.

NEW MEMBERS Qualified

These applicants who have qualified for admission to the Society have been welcomed into membership between June 10, 1943, and July 10, 1943.

The various grades of membership are indicated by: (M) Member; (A) Associate Member; (J) Junior; (Aff.) Affiliate Member; (SM) Service Member; (FM) Foreign Member.

Baltimore Section: Eugene T. Bartholomee (J), Wallace W. Berchtold (A), Capt. George N. Chambers (A).

Buffalo Section: Donald Norman Badgley (J), Verne P. Donner (M), Earl Jack Swailes (A), Stephen Anthony Tirone (J).

Canadian Section: Robert B. Douglas (M), Capt. William Forsyth (M), Paul Ernest Hansen (A), Stephen Palmer (A), Ross L. Richards (A), Ben Sadowski (A), Cecil E. Simmons (J), J. P. Wanko (J).

Chicago Section: Russell Engstrom (J), Waldo J. Hall (J), George A. Leyner (M), Carroll Norman Rill (A), Arnold L. Robb (J), Lester L. Robinson (J), Edward A. Slindee (J).

Cleveland Section: Leslie L. Aspelin (M), John V. Cheraso (A), James H. Coolidge (A), Walter E. Enstrom (J), Arthur J. Federkiel (A), Joseph J. Federkiel (A), Russell R. Fike (M), Otto G. Friedl (M), Glenn Robert Graham (J), Walter C. Grosser (M), Rudolph Jarosh (A), Monarch Rubber Co. (Aff.) Reps.: John R. Corrigan, Robert F. Simpson, Edwin F. Pain (J), Emil Pawek (M), Emery J. Szabo, Jr. (J).

Detroit Section: Lt.-Col. John A. Barclay (S M), Louis E. Barnes (A), Donald W. Bay (A), Alexander Cameron Crosman (A), Albert W. Degen (A), Norman T. Duvall (S M), Franklin Wesley Edwards (J), Nelson E. Farley, Jr. (J), Arthur Joe Franck (M), George Kimberly McCann (M), Donald H. McIver (A), T. P. Moore (A), William George Newman (J), William M. Packer (A), William L. F. Peters (M), Robert R. Peterson (M), Hubert S. Phelan (J), Sidney L. Riley (J), Richard K. Scales (M), Danny Yuke Sing (J), Silas C. Snyder (A), George F. Stacy (J).

Indiana Section: Vincent Robert Kelly (J), Robert C. Myers (M).

Metropolitan Section: John Babey (A), Hermann W. Baer (A), Lewis A. Bondon (J), William J. Colson (J), Salvatore Theodore Federico (J), Samuel S. Fink (J), Harold D. Hoopman (J), Capt. William C. Irving (S M), Dr. George Keinath (M), Paul V. Keyser, Jr. (M), Robert Kopple (A), Theodore Frank Kuzyn (J), Frank Byrd Lary (J), William P. Lester (A), Edmond McConnell (M), William J. Morrison (M), Harlan Leonard Nelson (A), George J. Philippi (M), B. E. Rawlings (A), Lt. (jg) George C. Scott, Jr. (J), John P. Sherwin (J), Harry S. Shorey, Jr. (J), Robert George Smith (J), Lt. Edwin D. Thompson (A), Richard B. Wilkinson (J).

Mid-Continent Section: W. L. Thompson (M).

Milwaukee Section: Lester E. Kleist (M), Jesse C. Knoll (J), Robert F. Stuth (A).

Muskegon Club: Harold N. Myers (M).

New England Section: Ensign Windsor Lewis Sherman (J), C. Richard Soderberg (M).

Northern California Section: Francis G. Bollo (J), Richard Frank Bradley (A), Mountford Val Gatter (A), Eugene H. Plamondon (A).

Northwest Section: Robert B. Harlan, Jr. (J), Howard G. Ridley (J), Walter R. Wiberg (M).

Oregon Section: Leland James Cronkhite (A), Carl F. Hartman (A).

Peoria Group: Nicholas Kent (J).

Philadelphia Section: Edward N. Ferris (A), S. F. Wollmar (A).

Pittsburgh Section: Clay Ballinger

WHEREVER THE GOING IS TOUGHEST!

It may be on a bulldozer moving and leveling ground on an important military road or strategic air field. It may be on a farm tractor working day and night . . . or on sterilizers in field and base hospitals . . . or on a bilge pump in a ship's hold . . . or on an air compressor assigned to important war work. Wherever there is a tough job of pressure indication to do, Rochester Gauges can always be depended upon to do that job accurately and dependably . . . even when the going is the toughest! The 2 BP (illustrated) is but one of many Rochester Indicating Instruments serving the war effort and industry alike. Bulletin GG-343 gives complete information. Write for it today!

Rochester Manufacturing Co., Inc., 21 Rockwood St., Rochester, N. Y.

(M), N. G. Bayster (A), Edward R. Prosser (M), Ronald B. Smith (M), George H. Woodward (A).

SAE Club of Colorado: Edward G. Sander (A).

St. Louis Section: Innes Bouton (J), Donald W. Irwin (J), Hugh D. Reading (A), 2nd Lt. Rollin D. Richter (S M), Frank L. Seesock (J).

Southern California Section: Ernest Adler (J), P. J. Brady (M), Duncan C. Crooks (A), Eugene John Freeman (J), James M. Gerschler (M), Lester R. Hill (A), David R. Jones (A), Norman M. Jones (A), A. R. Perl (A), William Henry Rager (J), Ray Reimer (M), Arthur M. Lind (A), Walter M. Schindler (M), James G. Soteriou (M), H. E. W. Tinker (M), J. H. Wallace (M).

Southern New England Section: H. Wilson Bonnett (M), George M. Danks (J), Edward Sorant (J).

Southern Ohio Section: Seeley Earl Buck (J), Carl Albert Elsbernd (J), William Golden (J), Joseph Franklin Larwa (J), Ervin A. Lauch (J), Charles M. MacDonald (J), Joseph F. Maletz (A), Robert O. Vance (J), C. William Viets (M).

Texas Section: Murrell Adams (M), John D. Scruggs, Jr. (A).

Twin City Group: Alfred J. Fleury (M), Rex Franklin Jeide (J), Myrl A. Lindeman (J).

Washington Section: Marion W. Cullen (S M), Robert F. Gaither (J), Capt. Emmons S. Lombard (A), Peter J. Soca (J), Col. John Henry Smith (F M), Hansford B. Truslow (M), Charles Wm. Witherow (J), Lt. Alan Hazeltine Yates (S M).

Wichita Section: Charles M. Edmonds (J), William Lee Gray (J), Otto Albert Radermacher (S M).

Outside of Section Territory: Lt. Orville L. Adams, Sr. (A), Major Wayne B. Hemphill (A), Louis Klein, Jr. (A), Steven M. Rostas (M), George J. Toth (J), 1st Lt. George Pennelton Wells (A).

Foreign: Ian Gair Duncan (J), (England), George Herbert Miles (F M), (England), Leslie Clarence Thomsett (F M), (England).

Applications Received

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Wichita Section: John S. Lawrence.

Outside of Section Territory: Donald A. Adams, Morris C. Anderson, J. G. Dorward, Stewart Fortune, Roy Gunard Frogness, Walter C. Jamouneau, J. R. Mohlie, Edward W. Pye, Robert A. Schorr, Virgil L. Tweedie, Fred J. Villforth, Jr.

Foreign: Capt. R. P. Hamilton Ash, (India), Lt.-Col. W. H. Binns, (England), Manuantrai Dayalal Mehta, (India), Eric Walter Mole, (So. Africa), Thomas Norman Leofrio Pughe, (England), John E. Tobin, (T. H.).

Here's the *MODERN WAY* to CATCH HORSE THIEVES

With human life often dependent on motor performance, our Army is taking no chances on the condition of new, overhauled or rebuilt engines.

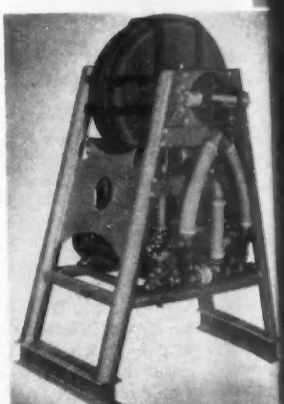
Before a replacement engine is installed in a motor vehicle, it must *prove* its condition by pulling loads which closely simulate actual operating conditions.

The Clayton dynamometer unit, illustrated above, provides these varying loads and measures the power output of the engine throughout its entire performance range. This procedure *guarantees* tip top mechanical condition, with every possible "thief of power" captured and eliminated!

Like all Clayton dynamometers, this engine test unit is simple, accurate and produced from a minimum of critical materials. Specially developed for overseas use, it is completely self-contained. No electric current or water supply is required for cooling either power absorption unit or test engine.

Clayton dynamometers of another type are testing new, giant aviation and marine engines. "Laboratory" accurate, they cost less and require a minimum of technical skill for operation and upkeep.

Models from 50 to 4000 H.P. for laboratory use or production testing.



Clayton 2400 Horse Power Engine Dynamometer, controlled by a flick of the finger, requiring only 29½x45 inch floor space. Weight 1875 lbs.

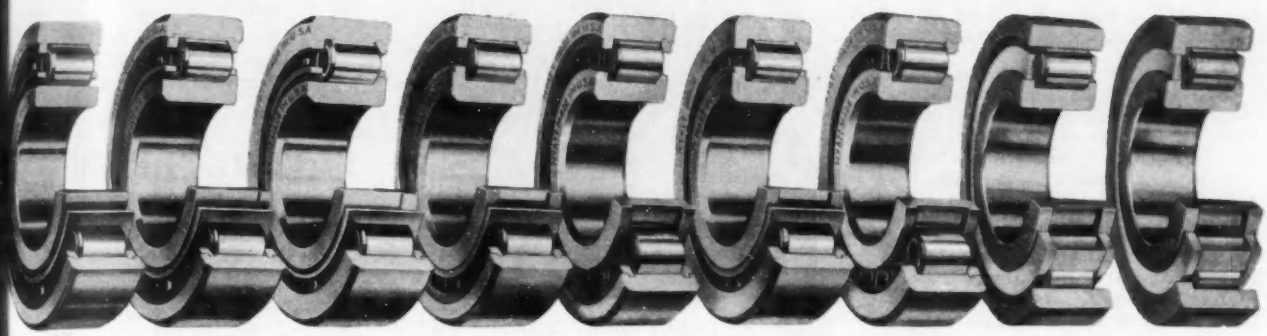
● Other Clayton Products serving the Armed Forces are Kerrick Kleaners... Kerrick Cleaning Kompounds... Clayton Steam Generators... Clayton Boring Bars and Bar Holders, and Clayton Hydraulic Liquid Control Valves.

CLAYTON MANUFACTURING CO.

ARMY E NAVY

ALHAMBRA CALIFORNIA

HYATT HAS THE ANSWERS



A-TS R-TS R-YS U-TS U-TM U-YS U-YM BU-Z BU-L

TO ALL YOUR RADIAL BEARING PROBLEMS

...With 9 Different Types of Hy-Load Bearings.

In light and medium series, narrow and wide widths. Made to American Standards Association boundary dimensions—and to Hyatt standards of quality. The check list below shows how Hyatt Hy-Loads can solve radial bearing problems for you. For further information, write for Bulletin 541A.

A-TS For shafts of fixed location, carrying torsional and radial loads only.

R-TS Same as above, but with one flange on the inner race.

R-YS Where bearing is required to take light or intermittent thrust loads and locate the shaft in one direction. Has flange on inner and outer race.

U-TS Where application has no provision to retain the outer race endwise, or where bearing must be assembled as a unit.

U-TM For additional capacity on slow speed applications. Similar to U-TS, but separator is omitted to allow maximum number of rollers.

U-YS When bearing must be assembled as a complete unit, and sustain light thrust or locate shaft in one direction.

U-YM For additional capacity on slow speed applications. Similar to U-YS, but separator is omitted to allow maximum number of rollers.

BU-Z Where mounting conditions require that the roller and inner race assembly be kept with the shaft.

BU-L Where bearing must also locate the shaft or sustain light thrust loads in one direction.

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HYATT ROLLER BEARINGS

HYATT BEARINGS DIVISION • GENERAL MOTORS CORPORATION • HARRISON, N. J.

About SAE Members

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COL. JOSEPH A. CELLA has been transferred from Fort George Wright, Washington, to Headquarters Second Air Force, Colorado Springs, Colo.

FRANK D. ST. HILAIRE is flight engineering foreman-mechanic at Ranger Aircraft Engines, Division of Fairchild Engine & Airplane Corp., Farmingdale, L. I., N. Y. Mr. St. Hilaire had been oil refinery supervisor for Trinidad Leaseholds, Ltd., Trinidad, B. W. I.

JOHN A. JAMES is working as fuel-research engine operator in the technical service department of the Socony-Vacuum Oil Co. Mr. James had been an engineer with Johnson, Drake & Piper, Inc., New York City, and also diesel engineer, foreign service, U. S. Army, Corps of Engineers.

RICHARD C. ALAND has left the Intercontinent Aircraft Corp., Miami, Fla., where he was an engineer, to join Continental Motors Corp., Detroit, as an engineer in the new engines department.

CORP. GUY E. FINOUT, JR. has been transferred from Aberdeen Proving Ground to the 40th Ordnance Company Detachment, Erie Proving Ground, La Carne, Ohio.

CHARLES SARDOU, JR., was recently promoted to chief draftsman of Consolidated Vultee Engineering & Development Division, Downey, Calif. Mr. Sardou began with the Airplane Development Corp., predecessor of

Charles Sardou, Jr.

Vultee, in 1935, and has been chief draftsman for Kinner, and standards and patent engineer of Vultee. He was formerly membership chairman of the SAE Southern California Section.

HARVEY E. WHITMORE, who had been shop superintendent, U. S. Army Corps of Engineers, Granite City, Ill., has been transferred to Columbus, Ohio, as maintenance superintendent.

FELIX C. REICHLIN is now design engineer for the AiResearch Mfg. Co., Los Angeles, Calif. Mr. Reichlin was formerly connected with Kinner Motors, Inc., Glendale, Calif., as engine designer.

CLARENCE K. SENCEBAUGH is chief mechanical engineer in the plant engineering department of the New Orleans (La.) Division of Consolidated Vultee Aircraft Corp. He transferred from the San Diego, Calif., plant of the same company where he was mechanical engineer.

SAE student members newly engaged in engineering work at various production plants throughout the country include:

	Formerly at	*Employed by*
JOHN BARELOS	Lawrence Institute of Technology	Kermath Mfg Co.
ROBERT LAURANCE BENNETT	California Institute of Technology	Douglas Aircraft Co., Inc.
T. D. BUETTELL	California Institute of Technology	Douglas Aircraft Co., Inc.
JOSEPH L. CUMMINGS	General Motors Institute	Detroit Transmission Division, General Motors
JAMES T. COLIZ	University of Wisconsin	Federal Telephone & Radio
C. RAYMOND DAHL	Cooper Union School of Engineering	General Electric Co.
SEYMOUR DOLNICK	University of Wisconsin	Froemming Bros. Co. (Air Corps Reserve)
PHILIP DUFF	University of Wisconsin	North American Aircraft, Inc.
ROBERT L. GATES	Iowa State College	Thompson Products, Inc.
VINCENT C. GIULIANO	College of the City of New York	General Motors Detroit Diesel Engine Division
FREDERICK W. HALLETT	Curtiss-Wright Technical Institute	Instructor for Curtiss-Wright Institute
RICHARD K. HART	University of Wisconsin	Atlantic Division, Pan-American Airways
JAMES C. HUGHES	Purdue University	Research Laboratories, Ethyl Corp.
FRANK S. JONES	Yale University	Haynes Stellite, Inc.
DONALD S. JOHNSON	Lehigh University	Carl L. Norden, Inc.
ROBERT M. KUBOW	University of Wisconsin	Goodyear Aircraft Corp.
WARREN W. LEFFMAN	University of California	Allis-Chalmers Mfg. Co.
AUGUST A. LENART, JR.	Texas A&M College	Proof Department, Eglin Field, Fla.
ALBERT J. MILLER	University of Wisconsin	Atlantic Division, Pan-American Airways
JOSEPH MIODUSZEWSKI	Lawrence Institute of Technology	American Export Airlines, Inc.
VICTOR NEWTON	College of the City of New York	Sterling Engine Co.
ROBERT W. PARKER	Purdue University	Allison Division, General Motors Corp.
ROLAND W. STEPHENSON	University of Wisconsin	North American Aviation, Inc.
FRANCIS J. VIVIAN	University of Wisconsin	Fairbanks, Morse & Co.

Most Metals Are Critical

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plating coating wherever feasible to save cadmium, tin, nickel, zinc, or copper.

Ferrous Alloy Metals

- Molybdenum is very critical. Essential demand will exceed the 1943 supply. It should not be substituted for nickel unless more than 6 lb of ni can be saved by 1 lb of mo, conservation experts say.
- Nickel requirements exceed the year's estimated supply, despite huge outlays for additional capacity. It remains very critical.
- Vanadium is critical, and will about hold its own unless too much is used to substitute for the more critical mo and ni.
- Tungsten demand and supply are fairly well balanced at the moment. Any increase in demand to conserve more critical materials, or new uses, will upset the situation.
- Chromium availability is fair. Low carbon ferro-chromium is very critical due to insufficient furnace capacity. About 95% of the latter material is used for steel making.
- Manganese – good availability.

Ferrous Materials

- Alloy steel of electric furnace grades is very critical because of limited furnace capacity. Open hearth capacity is more available, and these types should be used wherever possible.
- Carbon steel is fairly available, particularly in smaller bar sizes of Bessemer types.
- Malleable Iron, with the present excess of production capacity, is generally available.
- Gray cast iron is readily available.
- Steel products:

Bars over 2 in. are very critical;

Plates, wire rope, wire products, and castings are less critical;

Structural steel, piping, sheet and strip, and rail steel bar products are generally available.

Low-alloy, high-tensile plates are fairly available, due to action of the Army Service Forces and WPB limiting the use of mo and ni in these plates.